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SELECTED CONTENTS

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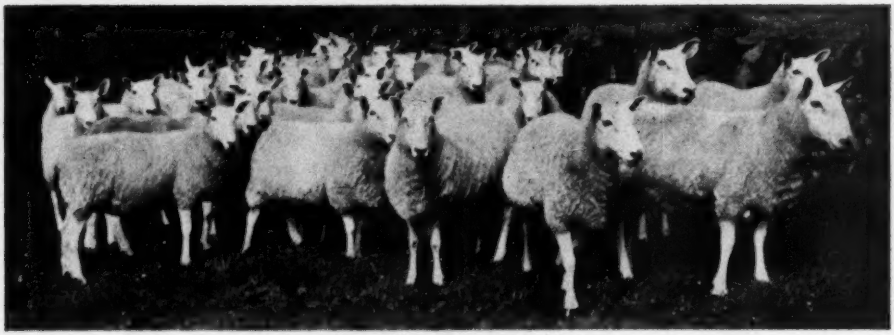

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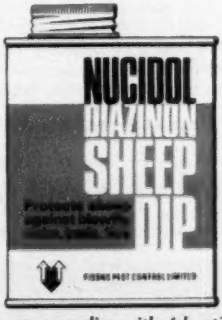
*Nucidol is a trade mark of J. R. Geigy, S. A., Basle, Switzerland.



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Agriculture

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Editorial Offices
Ministry of Agriculture, Fisheries and Food
Whitehall Place, London S.W.1. Trafalgar 7711

CONTENTS

Why Fisons fed plants with radioactive phosphorus

The common isotope of phosphorus is P^{31}. This is the isotope you get in fertilizer phosphorus. Fisons handle thousands of tons of it a year. But there is also a man-made radioactive isotope of phosphorus. This is P^{32}, produced when you bombard P^{31} with neutrons:

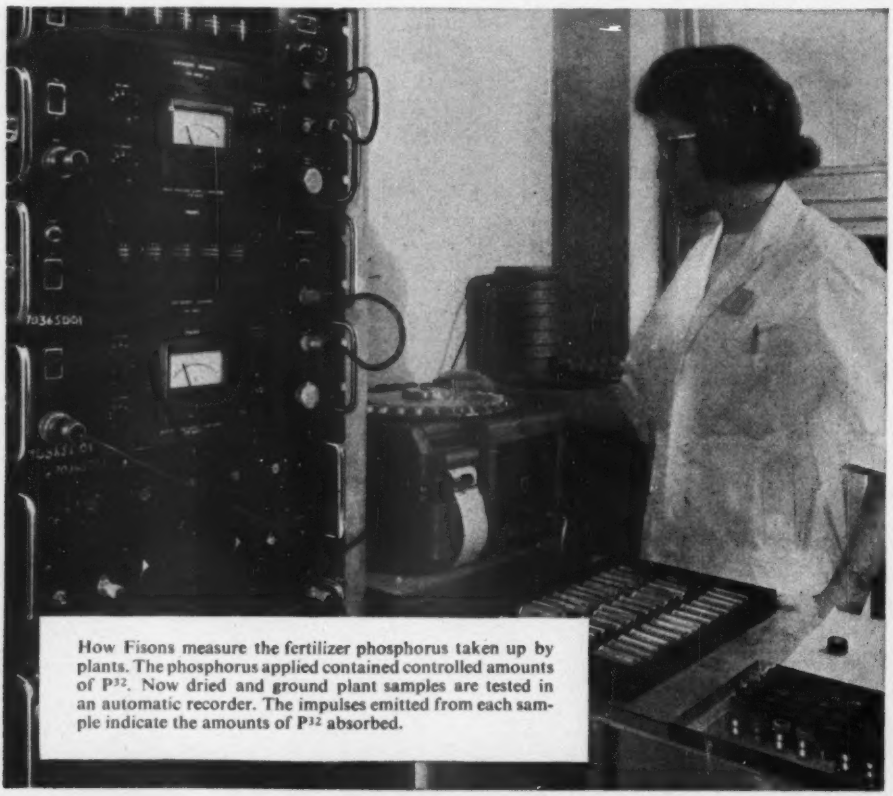
$$P^{31} + n \longrightarrow P^{32}$$

This isotope is, of course, never present in any fertilizer made available to the farmer. But in agricultural research, under controlled conditions, it can be a very useful tool. For it can be used to check the action of P^{31} in the soil and in plant tissue.

Chemically P^{32} is identical to P^{31}. Therefore they both behave in the same way. And so P^{32} can be used as a tracer for P^{31}. At Levington Research Station it is being used to measure the movement of phosphorus between the soil solids and the soil solution, and to calculate the reserves of available phosphate in the soil solids.

These studies are vital if we are to understand plant nutrition. For the soil solution holds little phosphorus. The supply must be replenished several times a day if the plants are to get enough of this element. The size of the available reserve is also important—before and after fertilizer is applied. This knowledge directly affects our control of crop production.

These studies, and related work, are being done at Levington Research Station on samples of soil from experimental sites all over the country. They are just one part of the important contribution Fisons make to our knowledge of plant nutrition and the use of fertilizers.

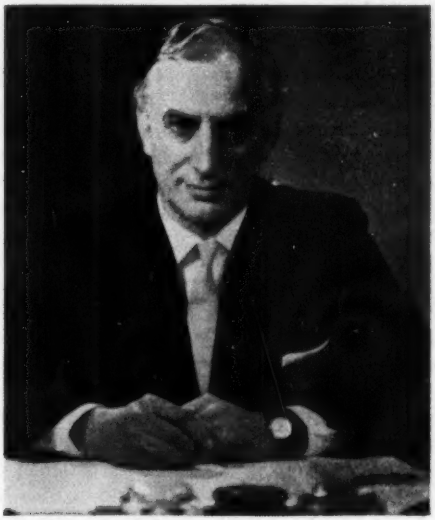


How Fisons measure the fertilizer phosphorus taken up by plants. The phosphorus applied contained controlled amounts of P^{32}. Now dried and ground plant samples are tested in an automatic recorder. The impulses emitted from each sample indicate the amounts of P^{32} absorbed.

The Rt. Hon.

Frederick Peart, M.P.

Minister of Agriculture, Fisheries and Food



Biographical details on p. 536.

On my appointment as Minister of Agriculture, Fisheries and Food in the new Government, I should like to send my greetings to the readers of 'Agriculture'. It was my good fortune to serve my political apprenticeship as Parliamentary Private Secretary to Tom Williams in the 1945-51 Government, and that has stood me in good stead in following the development of our great farming industry since then.

No one doubts that the nation is on the threshold of exciting technological developments—and of these the agricultural industry will certainly take its full measure. Science has become the close partner of husbandry, and I am confident that that partnership has still greater rewards to offer. I pledge my full support for agriculture in the challenging times ahead.

Fred Peart

BE WARNED!

Mastitis is usually the result of bacterial infection of the udder.
Infection is almost always through the teats.
Infection is brought to the cow usually during milking by the milker's hands, udder-cloths and teat-clusters

The Scourge of MASTITIS

C. D. Wilson

THE incidence of mastitis in our cattle is higher today than it was twenty years ago. This is particularly surprising in view of the development of improved forms of treatment—notably antibiotics. Just how *much* more mastitis there is cannot be stated, because no detailed surveys were carried out before the war. The most recent survey, admittedly in just a few herds, showed that in *one month* 14 per cent of the cows had clinical mastitis—by which is meant that the cows showed obvious symptoms of disease and treatment was considered necessary.

Even more widespread is sub-clinical mastitis. Here both the udder and the milk appear normal, but there is a high content of pus cells in the milk associated with bacterial infection of the udder. In one survey of 5,000 cows, 25 per cent were found to have sub-clinical mastitis at any one time. Another survey showed that half the cows were infected during a lactation.

Cows with clinical mastitis usually lose around 20 per cent of their expected milk yield in an affected lactation; in the case of sub-clinical mastitis, the loss is around 10 per cent. If half the cows lose one-tenth of their expected yield of milk, the annual loss can be put at nearly £20 million!

There is another way in which milk is lost. Milk from cows treated with antibiotics should not be sent forward for human consumption for some time, usually forty-eight hours after treatment. While no penalties are being imposed at the moment, it will not be long before the Milk Marketing

Board impose price or other penalties on farmers whose milk is found to contain antibiotics.

Add to this the loss in cows, in quarters and the cost of treatment, and it is readily seen why, economically, mastitis is the most important disease of dairy cattle.

Reasons for its increase

Many theories have been put forward to explain why there is more mastitis today, despite advances in treatment. Three, at least, are worthy of consideration.

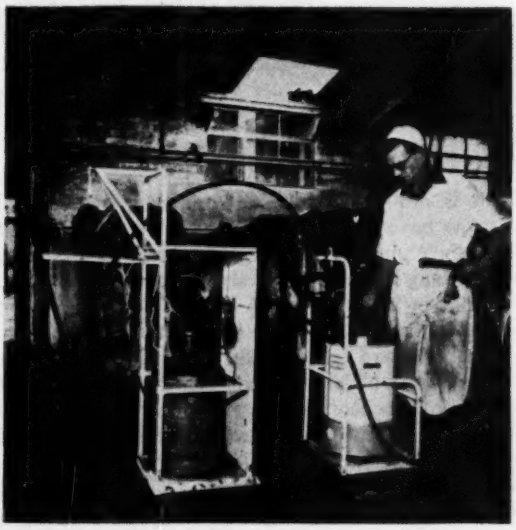
First, with the great improvement in farming generally, by better management, better feeding and better breeding, there has been a substantial increase in the average yield of the national herd. In 1945 the average yield was approximately 500 gallons; today it is over 850 gallons. This 70 per cent increase has put a much greater strain on the constitution of the cow; it has enlarged the udder and made it more vulnerable to injury.

Second, there has been a marked change in the method of milking. Not only are nearly all cows milked by machine, but the number of cows milked per man is increasing all the time. The milking machine is certainly an important factor in the incidence of mastitis.

Third, antibiotics for the treatment of mastitis have often been wrongly applied. They have been used to treat the clinical case and quell the obvious symptoms, but mastitis is a *herd* problem and must be dealt with as such. Clinical cases must be treated, of course, but their occurrence should serve as a warning that a herd problem may be present and that skilled advice should be sought to control it.

What are the possibilities of treatment?

Various methods have been used to bring mastitis under control. Vaccination is an attractive solution, but there are no vaccines available



Pasteurizing a cluster by sucking hot water (85°C) through it for six seconds, using an automatic teat-cup washer and a gas-heated water container. The vacuum to the washer is supplied from a central tap in the cowshed through a long polythene hose. The unit can thus be moved easily up and down the shed

today which give protection against all forms of mastitis. Claims have been made for certain staphylococcal vaccines, but notwithstanding that considerable work has been carried out in this country on these vaccines, none of them has been shown to be of benefit.

Only one organism associated with mastitis can, with any certainty, be eradicated by treatment of infected cows. This is *Str. agalactiae*, which is found only in the udder of infected cows. Eradication is usually a simple procedure but some herds do present difficulties, particularly large herds. Infection can be reintroduced by the purchase of cows, and therefore the importance of treating all such cows before they are allowed to enter the herd is self-evident.

Treatment of staphylococcal mastitis is much less successful. While many cows can be cured, some have to be culled. Reinfection is a constant danger.

Emphasis is on hygiene

Strict attention to hygiene will do much to limit the spread of infection during milking. The hands should be kept away from the udder as much as possible and should be immersed in a disinfectant solution before milking each cow. Sterilized individual udder-cloths should be used to wash the udders. This may appear to be both expensive and impracticable, but disposable paper-towels have been shown to be an effective substitute. They will not, however, remove caked dung or mud, which should be removed with running water and a sponge before the final wash of the udder with a suitable disinfectant.

Dipping the clusters in disinfectant after milking each cow is of doubtful value. It is better to run cold water through the cluster for 15 seconds or, better still, draw hot water (85°C) through it for 6 seconds.

The cold-water flushing method is well adapted to parlour milking, but the pasteurization method is practicable at present only in cowsheds.

By the use of these methods it has been possible to prevent the spread and development of mastitis in experimental herds. Work in progress in commercial herds at the moment is encouraging. There has been a reduction in infection rate, in clinical and sub-clinical mastitis and an increased milk yield in most herds under observation.

Machines and milkers

It is not possible here to consider in detail the influence which these factors have on mastitis, but it is known that inefficient milking machines and their improper use are important factors in causing mastitis.* Surveys of milking machines have shown that only 10 per cent of them are working satisfactorily, while work studies on the performance of milkers have revealed that most are working inefficiently.

No standard time for the milking of a cow can be laid down, but an average rate of 10 cows per unit per hour is possible in bucket-plants and in parlours where there are two stalls to each unit. In parlours with only one stall to each unit, because of the longer unit-idle time, a speed of 7–8 cows per hour is reasonable.

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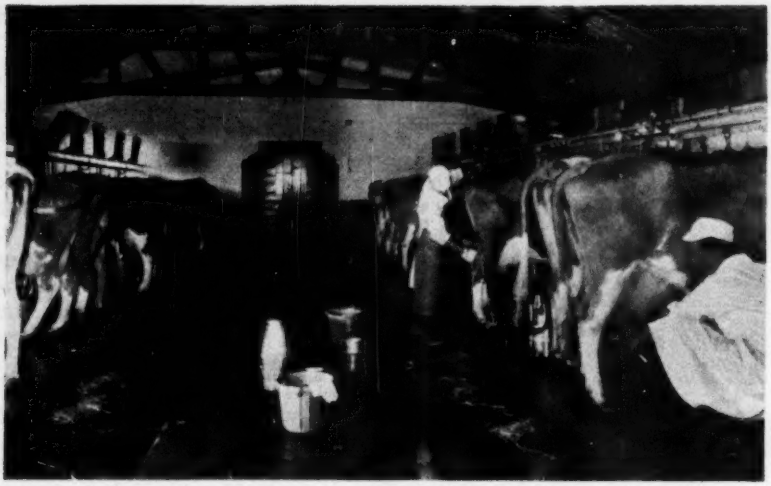
*J. Hutchison had something to say about this in our July issue.



Strict attention to hygiene will do much to limit the spread of infection during milking

No simple solution

There is no simple solution to mastitis. Much of the damage it does is not obvious and farmers are faced with a disease which is often difficult both to diagnose and to treat. In some countries the initial diagnosis is done at the milk collecting centres by means of an estimation of the cell-count of the milk. In certain States of America milk with too high a cell-count is rejected, and this has stimulated the formation of a National Mastitis Control Council in the U.S.A.

Were milk to be rejected in Britain for high cell-count, there would no doubt be a much more vigorous approach to mastitis control. By a combination of good hygiene, good milking technique, treatment of the curable cows and culling of the incurable, mastitis *can* be controlled.

C. D. Wilson, M.R.C.V.S., a Senior Research Officer at the Ministry's Central Veterinary Laboratory, Weybridge, Surrey, has worked on the problem of mastitis for the past eighteen years.

THE AUTHOR

Silage for Pregnant Ewes

A practice that gives earlier and more productive grassland for lactating ewes

Walter Smith

MOST of our sheep breeding flocks are now 'grassland flocks', that is to say they are maintained and carry out their productive function on enclosed grassland which may be on farms at sea level or perhaps at 1,000 feet or more. The general pattern of flock management on these farms, wherever they may be situated, is very similar; all are associated with utilization of grass in the production of lambs, whether for slaughter as fat lambs, for sale as store lambs, or as ewe lambs for further breeding. Traditionally, except for notable exceptions like Romney Marsh, grassland flocks have been associated with lower rented lowland or upland grassland, especially where natural drainage is good. Sheep production has been an extensive enterprise.

The intensive grazing systems recently developed (for example, forward creep grazing) are making sheep more competitive economically with other classes of livestock. The higher stocking rates of this intensive system compared with conventional practice means increased output per acre of grassland. On good grass, especially vigorous young leys, stocking rates of 10 ewes and 15 lambs per acre are not uncommon during the grazing season. Forward creep grazing not only permits greater intensity of grazing, but the concentration of the flock on a limited area during the active growing period of spring and early summer allows more land to be devoted to conserving grass for winter fodder, for both cattle and sheep. Thus more of the grassland can be kept free of stock in winter, which leads to earlier grass and cleaner pasture.

Silage intensifies output

It is no mere coincidence that silage is always the method of conservation on intensively stocked farms. Fields cut for silage towards the end of May, or at the latest early June, recover quickly and provide young fresh regrowth for mid-season grazing. Hay aftermaths, because of the later mowing, normally give only late summer grazing. Thus silage is the means of intensifying output as well as providing a source of high-quality fodder for winter use.

The best silage for any class of livestock is that made from wilted leafy grass before it reaches the flowering stage, i.e., towards the end of May. Conserved in this way, and provided the fermentation is good, silage gives a D.M. of 26–28 per cent, crude protein of 14–16 per cent and has a digestibility of 70 per cent.

After tupping, the ewes need not be done very well, and in early pregnancy it is particularly important to prevent them from becoming too fat. The following system of management is recommended. The ewe flock is used to graze off the pastures in autumn after cattle have been housed. The flock rotates round the farm, field by field, and as each field is grazed down the gate is shut and no stock go in until the spring. On well-managed grassland farms the flock is not tolerated all over the farm for the whole winter—a practice which only leads to late grazing in spring as well as light silage and hay crops.

Self-feed and Easy-feed: good performance

The cleaning-up process is normally finished by Christmas and the flock is then confined to one, or at the most two, well-drained grass fields which can be termed the wintering area. On light and medium loam soils the best method of feeding silage is from a stack or clamp made on the wintering area for use during January, February and March, or until early grazing is available. Young ewes with good teeth can 'self-feed', but if there is a high proportion of old ewes in the flock the silage should be 'easy-fed', being cut down and fed behind a barrier. Shearlings, because of their incomplete permanent dentition, should also be 'easy-fed'. It is essential to put slatted sections (6 ft $\times$ 3 ft) round the silage stack to keep the ewes out of the mud.

On light land it is possible to transport silage daily from silos at the farmstead to the wintering fields, but on heavier soils in wet weather tractors and trailers cut up fields. The provision of silage from stacks or clamps on the wintering area as described is therefore strongly recommended.

Farmers who have fed good silage to ewes are satisfied that there is no better feed for the in-lamb ewe in late pregnancy. Good silage may form the sole diet from Christmas until a few weeks before lambing, when a cereal supplement is introduced. The purpose of the concentrate supplement is twofold, first as a carrier for a mineral supplement and secondly to supply concentrated food when the appetite of the ewe in advanced pregnancy is lower.

Evidence of the value of good silage for in-lamb ewes comes from Bridget's Experimental Husbandry Farm. A silage-fed group was compared with a group running on grass in the conventional way. Silage was fed from Christmas until March, when lambing started. Average consumption per ewe was about 7 cwt over this period, i.e., about 10 lb per day. Supplementary concentrates at levels of 25 lb and 50 lb per ewe were fed to both

groups. The silage-fed group did equally as well as the grass-fed group and wintered on much smaller acreage. It is concluded that where silage is fed, two-thirds of the grassland can be kept free of sheep during the period Christmas to March. This means that the rested grassland is earlier and more productive for lactating ewes.

For housed ewes

The heavy clay soils like those of the Midlands and part of the North are liable to poach, particularly in wet winters on intensively-stocked farms. Hence interest has been stimulated in housing ewe flocks in order to free grass of stock in winter, and promote its productivity in the grazing season.

On the heavy clay land on the Paradise area of Cockle Park (University of Newcastle upon Tyne) ewes are housed in an open-fronted lofty pole barn with a slatted floor. Silage is conserved in the barn in a central clamp and made early in the season—a high-quality product. It is cut and fed into troughs outside on a concrete forecourt. Hay and concentrates are fed indoors. The system has worked well over the past three winters, giving an average lambing rate of 170 per cent.

Silage, therefore, is a suitable food for the pregnant ewe, but the overall effect of a silage system on gross output from the flock is an important contribution. It makes possible, on reasonably good land, a stocking rate of four ewes an acre over the year as a whole, or a gross output of the order of £40 per acre.

Walter R. Smith, B.Sc., N.D.A., was appointed Director of the Northern Region of the N.A.A.S. in February this year. He was previously Deputy Director of the Yorks and Lancs Region, and before that Regional Livestock Husbandry Officer for Wales.

CORRECTION

Systemic Insecticides against Warble Fly (*W. N. Beesley, September, 1964, issue.*)

At the foot of p. 419 it was stated that 'Dyvon' is marketed by Cooper, McDougall and Robertson Ltd.

This product is also distributed by Baywood Chemicals Ltd.

THE PROBLEM FARMS OF WALES

SMALL, FRAGMENTED,
IN DIFFICULT COUNTRY

Mechanizing Welsh Upland Farms

Ivan Warboys

WALES still has many small farms. Over 80 per cent of the 50,000 agricultural holdings are below 100 acres and over half of them are classified as hill and upland holdings. The problem farms are not the mountain or hill farms carrying sheep and raising cattle, nor the lowland mixed dairy farms, as on the coastal belts and in the more fertile river valleys, growing a relatively high proportion of corn and potatoes for sale. The difficult ones are the small hill and upland farms—small, not only in acreage but in size of business—which lie at between 300–1,000 ft. Dairy cows are the primary source of income, possibly supplemented by sheep, or pigs and poultry, making hay (occasionally silage) as the main source of winter feed, but growing some corn and roots for extra winter keep.

Problem of terrain

Add to these circumstances shallow soil, sloping ground and high rainfall, and the result is a difficult problem indeed. Small fields scattered in irregular patterns with little account taken of natural changes in the land surface, add to the cost of transport and often they are difficult of access by tortuous routes. Layout could be improved if, when the opportunity arises, land were to be exchanged between farms to make for more sensible field and farm arrangements. Today's field boundaries, such as banks and hedges, although providing valuable shelter in winter, prevent the use of large machines, tend to increase the amount of machine work time, and may make the quick drying and harvesting of the important hay crop an extremely difficult business.

Buildings have been a severe handicap for too long. Too many cowsheds limit the size of the dairy enterprise, with the result that milking may often take place in two or more buildings. This means more work for the cowman in carrying milk and in feeding and cleaning. Fodder stores are often suited to the days when labour was plentiful, and slope is seldom used to make work easier. Such buildings limit the amount of mechanical cleaning that is possible by tractor-mounted equipment, because doorways and passages are narrow, and firm level surfaces exceptional. Facilities for handling livestock are often poor; equipment such as cattle crushes and sheep tipplers are almost non-existent. In fact, apart from the use of milking machines and sheep shearing equipment, much of the routine work associated with stock is still done by hand. There is little mechanical assistance. Thus most of the mechanization on upland holdings has been concentrated on field work, with few mechanical ideas for the stock-keeper.

Problem of machines

To mechanize field operations under such conditions, one must ask whether the machines which are available today suit upland needs. The limited size of the market is not conducive to any major manufacturer providing small machines for use over such difficult terrain. Even when small machines are produced, they are often discarded for larger, more efficient specialist equipment; for example, the single-row haymaker has now been replaced by double-row machines. So the choice, operation and subsequent performance of existing machines become much more important to assess on farms which have to contend with sloping fields, shallow soils and a high rainfall. Slope affects the performance of many trailed machines, particularly haymaking machinery. Forage harvester and trailer combinations which are nearly always safe on level ground become highly dangerous on the wet stubble of sloping fields. Spinning disc distributors need even greater operator skill, so that farmers prefer their old-fashioned constant-width distributors, which perform much more satisfactorily.

The question whether the modern tractor is suitable as the major mobile power unit on such farms no longer arises, since such tractors are now a common feature of even the smallest holdings. Surprisingly, however, having spent say £700 on a new tractor, the equipment which remains to go with it may well be worth very little, the farmer being quite happy to operate his new tractor with equipment originally made for the horse!

From an examination of farm inventories it is clear that many farms are rapidly becoming junk-yards for secondhand obsolete equipment bought on the cheap. Often there is a tendency for capital investment in machinery to be as high as on mixed farms with much more arable land. The questions must then arise whether such farms are making the best use of their capital resources (often limited) and what would be a reasonable capital expenditure on machines for such a unit.

It is not proposed, however, to discuss the economic implications of this, but assuming in the first place that a given farm is operating with the most sensible and profitable combination of enterprises, how should this money be spent? Such decisions are difficult, even on good farms in fertile areas, but they become even more difficult on farms which are physically handicapped as well. In such areas the need for more machinery advisory officers therefore becomes apparent. The fact is that if such farms are to remain in

Secondhand equipment still plays an important role in upland areas

business then they must have a range of certain basic machines to enable them to keep abreast of the most up-to-date techniques and yet still keep their expenditure within bounds. Thus methods which reduce the machine requirement of individual holdings in such areas are of considerable interest.

Sharing machines

By reducing the number of enterprises and simplifying feeding systems, the total number of machines can be reduced. Too much attention is being paid to the tilling and harvesting of small acreages of crops such as roots and corn by the individual farmer. Agriculture in general is characterized by the wide range of tasks performed and materials handled; even more is this so of a small farm. As far as machinery co-operation is concerned a good deal of neighbourly lending already takes place, but this tends to be limited to cheap, non-seasonal types of equipment. The amount of formal sharing of equipment through machinery syndicates is small compared with other parts of the United Kingdom. Syndicates have been formed in Glamorgan, Brecon, Radnor, and Flintshire, and more recently in Pembrokeshire, but not so far in Cardiganshire or Montgomeryshire, two counties with a large proportion of hill and upland farms. Even where syndicates have been formed seasonal equipment plays little part; no case is known of, say, a baler being jointly owned.

Contract services

Contract services are widely available, mostly by small farmer contractors. They are generally treated with some reserve by those who use them little, and often cannot provide the range of equipment which was available during the days of the W.A.E.C.s. But farmers who use contract services regularly, recognize their value in reducing their own capital expenditure and providing a generally higher standard of machine performance than is available on most farms.

Multi-purpose machines

Multi-purpose machines offer a further opportunity of reducing the farmer's needs. The future possibility of providing a basic package for a small farm is not too distant. Provided the changes are simple and easily carried out and the capital cost is lower than the total cost of all the separate items put together, then multi-purpose machines have a place. In the field of transport and handling, such equipment is already available from manufacturers, and the multi-purpose trailer, with farmyard manure and artificial fertilizer spreading attachments which can be used as a forage box to cope with most handling operations, will have a future. On farms which rely on grassland, all that is required in addition is a basic grassland machine for grassland maintenance (topping and renovating) and for grassland conservation (cutting and tedding grass for hay or silage). In this field the latest development of flail mowers is looked upon with interest.

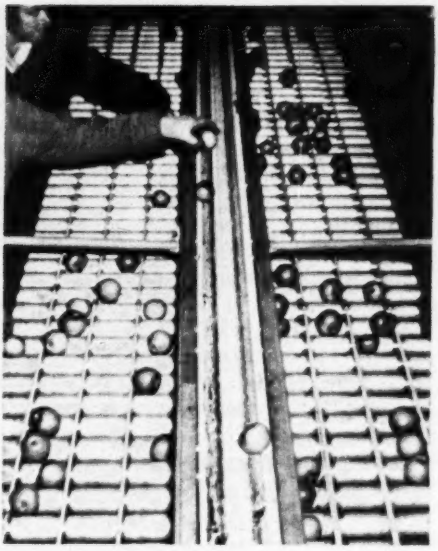
Winter keep

Finally, on many farms the amount of stock carried in the summer depends on the adequacy of the winter provision. In many cases this could be solved by purchase of hay, instead of trying to make it under difficult conditions. On the other hand, many farmers still prefer to make their own; and drying facilities, for conditioning field hay (rather than going for an exceptional quality product) to avoid having to leave bales out in inclement weather would be welcomed. The disadvantage of present hay-drying systems for many potential users is the requirement of a decent airtight building and the use of powerful fans. Systems which can dry bales *in situ* without the need for special walls and floor and operated by small electric fans, because they are ventilated radially, will be of considerable interest, particularly to growers of corn on the sheaf.

However, despite the obvious need for such facilities in grassland areas, the undoubted great technical strides in cereal growing and the present price situations between cereals, livestock and livestock products, and grassland, must mean more cereals in Wales and their production higher up the hills. Thus an increasing acreage of barley in upland areas, even as a replacement for the traditional hay or corn on the sheaf for feeding stock through the winter, is more than likely, except where the soil is unsuitable, or where straw is as highly valued as grain. It is interesting to recall that in a way history will be repeating itself, since cereals were much more widely grown in Wales during the first Elizabethan Age they they are at present!

The son of a farmer and agricultural contractor in Cambridgeshire, **Ivan B. Warboys, B.Sc.,** spent 2½ years as Lecturer in Farm Mechanization at Seale-Hayne Agricultural College before taking up his present appointment as Lecturer in Farm Mechanization in the Department of Agriculture, University College of Wales, Aberystwyth. A graduate of the Institution of Agricultural Engineers and a member of the British Grassland Society, he is at present concerned in a study of the mechanization of upland holdings and also in methods of grassland improvement.

Controlled roll sorting table for quality inspection



Mechanization can bring higher productivity, but not mechanization for its own sake

says

E. S. DEVINE

N.I.A.E., SILSOE

Apples on the Packing Line

OPERATOR performance is at the root of efficient packhouse planning. Labour costs are three times as high as they were in the 1930s, yet output per operator-hour, expressed as units of apples prepared for market, has not shown a comparable increase.

Whilst a high degree of mechanization is desirable, little benefit accrues from introducing pieces of packhouse equipment at random; what is needed is a careful assessment of the real requirements of the packing line.

Mechanization of the packing line must be staged in such a way that it balances out all along the production line; there is little use in mechanization that fails to give all the necessary operations an increase equal to each other. Mechanical aids for feeding the line, for extraction of cull fruits, polishing, quality inspection, sizing, box-filling, box-sealing and full container horizontal and vertical movement—all must be considered.

Smooth flow

A good packing line should be capable of operating efficiently at a fraction of its capacity as well as at full load, for there are likely to be seasonal as well as day-to-day variations in the volume of fruit to be handled. The thing to aim at is a smooth flow—either in a straight line or a right-angle pattern, isolating reception, market preparation and dispatch. Estimate the

optimum throughput required before planning starts. The estimated peak in the peak season is the figure to be looked for; and this can be determined by studying the production graph of the orchard plantation and the market trends over the previous five years. And don't forget the effect of new plantations when they come into bearing.

Measurement made in a number of apple packhouses has enabled the N.I.A.E. to establish a performance figure per man-hour for the entire packhouse staff. The average is 3·5–4 bushels—exactly the same as that in the mid-thirties! These figures are the production achieved in a traditional packhouse, where the fruit is 'additional' classified and where the final grades of sized material are presented to the market wrapped. To date, by judicious changes in packhouse mechanization and changes in the type of market container, it is possible to reach an operator performance per man-hour of 14–16 bushels. What are the changes necessary to achieve these startling increases in productivity—so necessary to meet rising labour costs, lower market returns and overseas competition?

Packing line operations

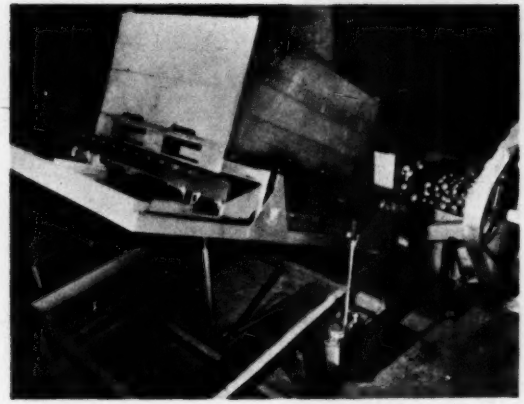
A well-planned packing line has fourteen different operations, and all of them can be assisted mechanically. Of these, the three key operations, feeding the line, inspection and classification for quality, and container filling, use up 85 per cent of the labour force.

Looking first, then, at feeding the line, if it combines inspection for quality, an operator performance of 8–11 bushels/hr can be expected. If the line is fed by tipping bushel boxes we can expect an output of 78 bushels/hr (by machine) and 60 bushels/hr (by hand). Bulk bin tipping should put the figure up to 120 bushels/hr, the only snag being that present-day packhouse layouts and existing machinery are unable to handle this quantity of fruit at any one time.

The question with bulk bins is: should wet or dry extraction techniques be used? A good, dry extraction unit can supply the quantity of apples needed in a packhouse with a throughput of up to 80,000 bushels/year, but above this figure it is essential to have faster bin emptying. Here, water extraction plays its part. A moderately large unit will give an extraction of 350–380 bushels/hr, but it is expensive. Among its many interesting features is that part of the tank's surface area can be used as a fruit reservoir, enabling the packhouse manager to keep a constant flow of fruit up to the quality assessment team, and so a smooth work pattern and maximum output per day. With dry extraction it is essential to have a bin-emptying device that allows the fruit to roll on to a power conveyor operating at right-angles to the original flow of fruit. The take-away conveyor should have a variable speed control, with a range of 10–25 ft/min and it should be 24 in. wide to allow for free movement of fruit as it leaves the bin. The bin-emptying unit should be capable of gradual tilting to allow the fruit to leave gently and designed so that the level of the floor at the door remains constant. The angle of repose for the final flow of Cox's from the bin bottom is 27 deg. and for flat apples (e.g., Bramley) 35–37 deg.

Inspection for quality

The most important operation in the packing shed is quality inspection, and the throughput here gives the capacity rating for the shed. The rating



Gentle-tip dry dumper for bulk bins

is in fact the number of fruit inspected per hour expressed in bushels divided by the packhouse staff in attendance at any given hour.

Fruit classification can be divided into either 'additional' grading, where all fruit is manually placed on to the grader (the limit here being the physical capacity of the operators) or 'subtraction' grading, where moving fruit is inspected and classified into grade lanes. This latter speeds up quality inspection considerably, as only part of the fruit is handled by the operators. Operator performance figures for each method studied are shown below:

Method of classification	*Method of presentation*	*Performance in bus./man-hr*
Additional	Hand-feed on to quality lanes	8–11 (varies with fruit size)
Subtraction	Flat belt (no lanes)	15
Subtraction	Roller conveyor (no lanes)	15
Subtraction	Controlled roll table	20 on a poor sample, rising to 32

The improved performance achieved by the controlled roll sorting table is due to the introduction of partial mechanization, together with correct loading of the operators. Good positioning of operators is also very important. A variable speed control is essential if the quality of the fruit is to be maintained.

Packing: six methods compared

The practice of wrapping fancy and choice apples is a luxury that few growers can afford nowadays; greater productivity can only be achieved by using some other internal protective measure. In the following table operator performance for each of six methods of packing is recorded:

Method	*Performance in bus./man-hr*
Wrapping	7
Cells (several types)	7–9
Jumble	18
Hand packing (leaves)	15
'Hartman' packer	23
Semi-automatic leaf pack	38

The figures for jumble packing are reasonably high, but this is not a good method of presenting fruit for market. The leaf packer, which is

The 'Hartman' manual leaf packer fitted in line for direct boxing-off of sized fruit

mechanically operated, gives the best results as regards both performance and cost. Attention must also be paid to full box take-away conveyors and the empty carton supply line. The use of power conveyors alternating with gravity is essential as a means of lateral movement when all apples are moved in units of bushels or less, and this is especially so when more than three packers are employed. Where the cartons are removed manually and placed on a take-away conveyor, three things are necessary: the take-away conveyor must be 30 in. behind the working station, it must be 6 in. lower than the base of the carton stand top, and the empty supply line must be 5 ft 6 in. above this line. Otherwise losses in productivity can amount to as much as 10 per cent. On new layouts, low level conveyors under the inspection and sizing machinery, together with 'ease-down' carton handling, is recommended.

An accumulator line is essential for the collection of all the cartons. Too many operators are often seen engaged on sealing, labelling and segregating the final cartons. An accumulated line brings all the cartons together.

Weigh cost before change

Before changing an existing system the following questions must be answered: what is the cost of the existing equipment (i.e., depreciation on a ten-year basis, interest and insurance), the operational costs per year (i.e., fuel and maintenance, replacements and maintenance labour), and production in bushels per hour per operator. The machine cost to process one bushel of apples is calculated from the answers to these figures. To obtain the full cost it is essential to add the labour charge per bushel, also the indirect costs and the buildings expenses.

A new layout giving the production benefits mentioned can be similarly costed before going ahead with the installations. And then there is always the possibility of co-operation with other growers, a high turnover justifying greater mechanization.

A VALUABLE GRASS

Early, Vigorous and Persistent

Tall Fescue (S. 170) in the Sward

H. K. BAKER • J. R. A. CHARD

TALL fescue (the botanists call it *Festuca arundinacea*) is a perennial grass similar in appearance to meadow fescue, but it has a generally coarser and larger appearance. Once established it is extremely persistent, vigorous and is one of the earliest grasses to grow in spring. There are only a few varieties in Britain. One of these—the Aberystwyth strain S.170—was bred from material collected in Buckinghamshire. This variety is leafy and has an early (but short) flowering season. It is winter hardy and grows vigorously from the beginning of spring to late autumn. Experimental work at the Grassland Research Institute, and co-operative trials throughout England and Wales with the National Agricultural Advisory Service, have demonstrated the value of swards based on S.170 for early spring and late autumn grazing, and for mid-season conservation.

One series of trials on farms, which particularly stimulated interest in tall fescue, compared the use of a mixture of S.170 and S.215 (meadow fescue) with an S.143 cocksfoot sward for autumn grazing. The swards were rested and top-dressed with 50 units of nitrogen per acre and were grazed by cattle from early November to mid-December. During this period, the tall fescue mixture remained greener and was more readily eaten: typical results are shown below. The tall fescue sward was also particularly early in the spring and generally started growth as soon as 12-month-old Italian ryegrass.

Yields of herbage and liveweight gains of growing cattle on tall fescue and cocksfoot swards rested from mid-August

	LATE GRAZING Nov.–Dec.			EARLY BITE March
	Herbage yield	% digestibility	Liveweight gain	Herbage yield
	lb D.M./acre		lb/head/day	lb D.M./acre
Cocksfoot/white clover	2,040	69	0·5	520
Tall + meadow fescue/ white clover	2,060	73	1·5	1,030

Establishment

There are several problems associated with the use of tall fescue. Although its seed is large, it has the reputation of being difficult and slow to establish. Because of this, tall fescue should not be sown in mixtures with aggressive species such as Italian and perennial ryegrass or cocksfoot. These are so competitive in the early life of swards that they prevent the successful establishment of tall fescue. The small proportion of tall fescue will not materially affect production from such mixtures, and because of its quicker growth the individual plants of tall fescue will usually be more mature than the rest of the sward and will be ignored by stock. Sowing tall fescue with unaggressive grasses such as timothy and meadow fescue, or with red and white clover, gives increased production in the early life of the sward and helps to prevent weed invasion. Provided enough tall fescue seed is used, these species do not reduce its establishment, and a productive sward results.

Production from tall fescue mixtures during first harvest year (1963)
(lb D.M. acre—5 cuts)

Mixture and seed rate/acre		N applied per year: 114 units per acre	270 units per acre
S.170 tall fescue plus S.48 timothy	16 lb + 8 lb	9,030	11,900
S.170 tall fescue plus Broad red clover (early-flowering)	18 lb + 6 lb	8,930	12,240
S.170 tall fescue	24 lb	8,380	11,390

All swards sown with 2 lb per acre of New Zealand white clover

Westerwold ryegrass as a nurse

It seemed that the initial period of low production could be overcome by sowing tall fescue with an annual crop, such as Westerwold ryegrass, which would die after a flush of growth. To study this problem under a range of conditions, a series of trials was started at Hurley and on commercial farms in Cheshire and south-west England. The treatments included the use of Westerwolds as a nurse crop, and the sowing of tall fescue with cereals to be cut for silage or harvested for grain.

Effect of Westerwolds on herbage yields of tall fescue swards sown in April 1962

Westerwold seed lb/acre	Dry matter yields lb/acre		No. of tall fescue plants/sq. ft
	End May 1962	End April 1963	Oct. 1962
0	510	1,420	30
10	1,850	1,260	25
20	2,360	1,000	20

Westerwolds had a marked effect on herbage production during the first summer and produced very good yields. However, although it died out fairly quickly, it affected the establishment of tall fescue, and by the first harvest year yields were higher from the swards sown without Westerwolds. The reduction in number of tall fescue plants would be very harmful if many weeds —either broad-leaved species or grasses—were present, for they would quickly colonize the bare ground and reduce the effective life of the swards.

Sowing under cereals cut for grain tended to reduce the yields of swards in the following spring. The output in late May from swards sown the previous spring dropped from 1,500 lb D.M./acre when direct-sown to 1,200 lb per acre after undersowing for grain. Smaller differences in yield were obtained when the cereal was cut for silage, and this would appear to be a more useful way of obtaining worthwhile production shortly after sowing. As the objective of sowing a tall fescue sward should be to obtain a very long-lived ley, it is important to obtain a good plant establishment. Therefore either direct seeding or sowing with cereals for an early silage cut should be adopted.

It was thought that the method of seeding—either drilling or broadcasting the seed and harrowing it in—might influence the establishment. But there were no marked or consistent differences in the herbage yields that followed the two types of sowing. It should be noted, however, that good seedbeds were made in all cases, and the swards were sown in early spring when there was plenty of moisture in the soil. Had either of these factors been less favourable, drilling (rather than broadcasting) might have been better.

For good establishment, tall fescue should be sown early in spring into a fine, weed-free seedbed adequately fertilized and well consolidated both before and after sowing.

For grazing and conservation

Tall fescue has many good qualities: it is early in the spring, very vigorous during the remainder of the growing season and is persistent. Unfortunately it has a reputation for unpalatability—particularly during mid-season. To evaluate its usefulness to farmers—possibly as a perennial source of early bite—a number of tall fescue swards were established on dairy farms with contrasting environments. Fields were direct-seeded in spring, 1962; good takes were obtained at all the centres, and it is particularly interesting to note the production in the seeding year at the site in Surrey. There was very little production until August, but after that growth was vigorous. In three grazings from August to December a total of over 2,000 lb per acre of utilized starch equivalent was obtained by grazing with milking cows and followers. The production from three centres during 1963 is shown below.

*Yields from tall fescue/white clover swards (1963)**

Centre	Geological formation	Utilization	Dry matter yield lb per acre	Range of % digestibility	Utilized starch equivalent lb per acre
Surrey	London clay	7 grazings + 1 silage cut	10,750	68 to 80	3,250
Hants	Chalk	3 silage cuts + 2 grazings	10,810	70 to 77	4,200
Devon	Keuper sandstone	4 grazings + 2 cuts	10,560	71 to 83	3,560

*Seeds mixture per acre: 24 lb S.170 tall fescue. 2 lb S.100 white clover

At two of the centres—Surrey and Devon—there was no problem in getting dairy cows to eat tall fescue early and late in the season. At the Hampshire centre cattle grazed the first growth satisfactorily at first but the sward very soon became unpalatable and had to be made into silage. This is a reflection of the rapid growth of tall fescue, emphasizing that it must be used more frequently and intensively than other grasses. Once established, it tolerates heavy grazing for short periods, but continuous close grazing weakens the plants; a rotational system is recommended. Grazing must begin early in spring and, under fertile conditions, the intervals between grazings should not be longer than three weeks and swards should be topped to remove rejected herbage.

Very heavy cuts can be taken for conservation from tall fescue swards with surprisingly high digestibilities—2·2 tons of dry matter per acre were made into silage in Hampshire in May from grass with a digestibility of 78 per cent, and 1·75 tons of dry matter per acre were turned into hay in Devon from grass with a digestibility of 76 per cent. Because of its quick recovery, the resting period before cutting should be less than that of other grasses—5 to 6 weeks should ordinarily be sufficient. Hay and silage made from tall fescue are readily eaten by cattle.

Trials have shown that mid-season conservation is a good management for tall fescue, and it does not affect its persistency or value for late autumn grazing. Similarly, resting during the autumn, and grazing the accumulated herbage *in situ* during November and December, has a beneficial effect on subsequent vigour.

Because of its stiff leaves and erect growth habit, tall fescue is very compatible with white clover, appreciable quantities of which remain in the sward even after conservation cuts and applications of nitrogen. Tall fescue needs an ample supply of nitrogen. Under conditions of poor fertility it grows slowly, turns yellowish and is most unattractive to animals. The supply of nitrogen must therefore be maintained either through clover or through application of fertilizer.

Useful programme

A useful programme for a tall fescue sward would be to use it for two or more grazings in early spring, to cut for conservation during late spring and summer, and to graze again during the autumn and early winter. Tall fescue can be a highly productive grass and therefore needs intensive use. It would seem appropriate to have a small acreage of it on farms that need long-lived swards capable of providing very early and very late grazing. It must be stressed that the level of grassland management has to be high and that the swards must not be under-utilized.

The authors were responsible for the trials at the Grassland Research Institute described above. Both have, however, now left Hurley. **Dr. Baker** is with the Beef Recording Association (U.K.) at Reading, and **Mr. Chard** is at Padbrook Farm, Cullompton, Devon.

W. A. R. Harris

continues his article on

Pig Housing

the fundamental approach

IT is in the production piggery that the most spectacular results of work study have been achieved. It is a well-known axiom that every time a material is handled the cost is increased without altering its value. This is certainly the case with pigs. It is estimated that every time 100 lb of pig is moved it costs the equivalent of 10 lb of meal as the result of stress.

Not without reason, pigs are suspicious of humans; they seem to have a sixth sense which warns them of possible impending danger. Maybe at some future date there may be a demand for pig psychologists on our larger farms! To overcome this we have seen the development of Minimal Stress piggeries, where pen sizes increase with the growth of the pigs and the need for moving and mixing litters is reduced to the minimum.

In the production piggery

With the adoption of floor feeding, the elimination of feeding troughs alone has reduced the initial cost of piggeries by 15 per cent, apart from increasing the building utilization by anything up to 40 per cent. The protagonists of expensive mechanization for feeding and cleaning have certainly been made to think again when presented with the fact that, equipped with nothing more complicated than a functionally-designed trolley and weigh scoop, 300 pigs in a double-sided piggery can be fed in eight minutes by one man without undue exertion.

After persistent questioning, no conclusive proof has been forthcoming to show that pre-mixing meal with water improved the intrinsic value of the meal and indeed may increase the time for food preparation by 75 per cent. Of course this does not preclude the possible use of water as a vehicle

of distribution in a pipeline system in a large installation if the capital and running costs could be economically justified.

Up to the present time, the feeding of skim milk, with all its attendant constructional problems concerning pipe cleaning, expensive troughs and storage difficulties has complicated the feeding routine. Even taking into account improved meat texture, under normal conditions, in medium-sized piggeries, by the time supplementary balancing ingredients were added, reduced pen utilization and throughput due to troughs realized, the net economic advantage of feeding skim milk depended on a very favourable price per gallon.

To reduce wastage of meal (which is alarming on some farms) and the high initial cost of tubular and sheet steel or concrete pen fronts, high-tensile wires have been introduced successfully in many piggeries.

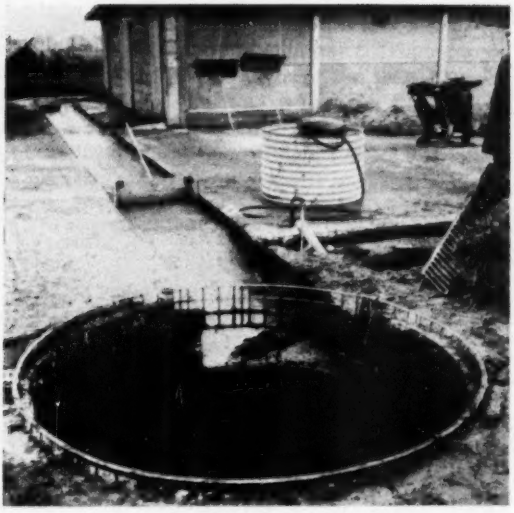
The other major chore in piggeries is mucking out. It takes a man 15 minutes to muck out 300 pigs, of which 7½ minutes are spent in opening dung passage doors. To achieve this impressive performance all that is necessary is a predetermined work routine, a squeegee costing £2–3, and a properly profiled dunging passage floor. In other words, it costs 6½*d.* per pig to muck out to bacon weight. Very careful thought would have to be given before embarking on high capital cleaning systems and mechanization to improve upon this.

Two other jobs where work study has made an effective contribution are the weighing and loading of pigs. These vary from being a veritable nightmare campaign on some farms to smooth, swift and safe operations on others—depending upon the degree of thought and planning that has been applied.

Look before you leap

It is not only in the planning and building of new piggeries that the benefit of this fundamental approach can be fully realized. Every effort must

Mucking out—a major chore in piggeries



This picture shows how dung from the piggery can be transported easily and quickly to an underground tank, one system of temporary storage

be made to explore the possibilities and to ascertain that potential output has been achieved in existing buildings. Only when adaptation costs are prohibitive and alterations are impracticable, should new buildings be considered.

This was clearly illustrated in a work study carried out on a farm in Somerset by officers of the A.L.S. An L-shaped cowshed was converted into a fattening piggery for 196 pigs, with a covered slatted dunging passage constructed on the outer side of each 'leg', the slurry being collected in a tank below ground near the corner. Feeding was done from McGuckian-type cross passages off the main passages on the inner walls, the latter converging at the meal store contained in the inner angle of the 'L'.

On investigation it was found that every ounce of meal had to be carried in buckets from the meal store, the floor of which was 20 inches above the level of the rest of the piggery, and the pig man was spending 4½ hours a week cleaning the pens (although slatted dunging passages had been installed at considerable expense).

When asked the reason for this laborious routine, it was explained that as the main feeding passage was only 2 ft 6 in. wide, this prohibited the use of any known trolleys. The 20-inch step was incorporated when, initially, it was thought a trolley might be used and, of course, it was thought that all mucking-out problems would automatically be solved when the slatted floor dunging passage was installed.

This state of affairs was accepted by both management and workers with fatalistic resignation. But not by the work study team. After persistent questioning and critical analysis, which inevitably involved husbandry specialists, equipment manufacturers, and others, it was suggested that the difficulties would be overcome and the routine improved if a special trolley to fit the main passage was obtained. This, with floor feeding and the elimination of secondary feeding passages, would have enabled the feeding time to have been halved, saving 76 man-hours a year, and 180 miles of walking, carrying heavy buckets for half this distance. In addition, stocking

capacity would have been increased by 60 pigs, thus eliminating the need for a contemplated additional house which might have cost £1,200 or an annual capital charge of £120 against a clear profit on an extra 180 pigs.

The dirty habits of the fatteners were attributed to such things as methods of housing them as weaners and growers, wrong technique of introduction to the production piggery, and faulty positioning of the water-bowls in the dunging passages. It was estimated that cleaning could have been reduced to 16 minutes a week.

Keep an open mind

I do not think that anyone can deny or ignore the value of a technique such as this which can and is influencing so effectively the working methods, and logically the resulting design of pig buildings. As long as we can agree on the desirable and economically justified features, and not lose sight of the fact that a situation could arise when it would pay to give the pigs a little more food and a little less costly environment, pig farmers and their advisers would not go far wrong.

When asked what he thought was the prime consideration of a well-designed piggery, one old pig man replied: 'If the designer is prepared to spend the night in it, then it is all right for the pigs'. Maybe there is a lesson to be learned here.

The first part of Mr. Harris's article appeared last month

Transfer of the Poultry Testing Stations

The British Egg Marketing Board has taken over responsibility for poultry testing from the Government. Ownership of the poultry testing stations at Phoenice, Surrey, and Wheaton Aston, Staffordshire, were transferred to the Board at Michaelmas. A third station, at Edinburgh, is not required by the Board and will be sold by the Government; a fourth station in Yorkshire, also not required by the Board, was sold last November.

In addition to transferring ownership of the Phoenice and Wheaton Aston stations, the Government will pay to the Board, over the next four years, a sum of £85,000 covering initial financial assistance towards the cost of testing and consideration for the Edinburgh station. The Board will also receive the proceeds of the sale of the Yorkshire testing station and of equipment provided by the industry at other stations but no longer required; the amount is likely to be over £80,000.

The four poultry testing stations were set up in 1956 and 1957. The initial capital cost was about £630,000, and this was met by the industry by means of a deduction from the egg guarantee payments. Subsequent capital expenditure and running costs were met by the Government.

In 1961 the Government proposed to the industry that they should assume responsibility for poultry testing. The industry later invited the British Egg Marketing Board to operate the tests on their behalf, and the Board announced their agreement in principle to this last year. The present agreement marks the end of the detailed discussions which have taken place since then.

The term 'fowl pest' is used in legislation to cover two distinct diseases, Newcastle disease and fowl plague. Since fowl plague has very rarely been encountered in Great Britain, fowl pest has become almost synonymous with Newcastle disease, and it is against the common forms of Newcastle disease that a vaccination policy is being pursued.

On 1st April, 1963, the Ministry's slaughter policy was abandoned in England and Wales in favour of a policy of control by the voluntary use of inactivated vaccine, the slaughter policy being retained for the very rare peracute form of Newcastle disease and for fowl plague; it is also retained for all forms of fowl pest in Scotland

J. W. Simpson

FOWL PEST

The first year of vaccination

THE first year of vaccination against fowl pest ended on the 31st March, 1964. During this time 2,736 outbreaks of Newcastle disease were confirmed. Over similar periods there were in 1962–63 3,337, in 1961–62 1,576, in 1960–61 1,869 and in 1959–60 2,697 outbreaks. This must be regarded as a satisfactory measure of control for the first year of a new policy, especially when it is remembered that it was achieved without the destruction of millions of birds and hatching eggs; in 1962, the last full year of slaughter, 11·5 million birds and 2·4 million eggs were destroyed at a cost of £8·76 million.

Many people feared that the ending of the slaughter of infected flocks and their contacts would result in the rapid dissemination of infection to many parts of the country hitherto relatively free from disease. This did not happen. During the year 220 million doses of vaccine were sold, enough to give maximum protection to about two-thirds of the poultry population, and the rate of uptake during the last six months has been even higher. If maintained at this rate, nearly three-quarters of the turnover of poultry should be protected—an encouraging start. A coverage of 85 per cent should achieve good control.

Reply to the critics

But the new policy has not been without its critics because, although it has minimized the effect of the disease when it developed, vaccination has not prevented all vaccinated birds from getting fowl pest. Birds have not always been given full protection by vaccination for a variety of reasons. Improper storage and use of vaccine, unduly heavy challenge resulting from too many unvaccinated flocks in the neighbourhood becoming infected, poor security measures resulting in birds becoming infected before they had time to develop an immunity through vaccination, or sometimes failure to revaccinate at the proper intervals, contributed to the number of outbreaks in vaccinated flocks. Official records are of necessity limited to confirmed outbreaks. The many flocks which, although exposed to infection escaped the disease, do not come to official notice. However, within the Ministry's own experience, a Berkshire flock, vaccinated over a period by the Ministry's field staff according to the manufacturer's recommendation, became heavily exposed to field infection and completely withstood the challenge of more than a dozen nearby outbreaks, the nearest 12 yards away! The flock comprised birds of varying age groups which had therefore been vaccinated a varying number of times. Thus it is evident that vaccine can and does prevent flocks from developing the disease.

. . . as figures show

In a random survey of 472 outbreaks made between 1st April, 1963, and 31st March, 1964, in which 203 flocks were vaccinated, records were kept of the various units of different vaccinal status in these flocks: 103 units were once-vaccinated; 56 were twice-vaccinated; 39 three-times vaccinated; 3 four-times vaccinated and 101 either vaccinated too long ago to have any great degree of residual immunity or too recently to have developed maximum protection. The total deaths in these flocks, including culls resulting from fowl pest and secondary infections, amounted to 6·37 per cent in once-vaccinated birds; 1·97 in twice-vaccinated; 0·83 per cent in three-times vaccinated; 0·14 per cent in four-times vaccinated and 10·21 per cent in the 101 not fully protected units. The corresponding mortality in the 269 unvaccinated flocks was 11·17 per cent. There was a similar progressive reduction in the number of birds showing symptoms of disease as successive vaccinations were carried out. So much so, that in many of the three- and four-times vaccinated hens the only symptom recorded was a drop in egg production.

Comparative figures of egg production for birds vaccinated once, twice, three times and four times were not kept, but in 208 unvaccinated laying flocks egg production dropped to nil in 83 per cent of cases and in only one (0·4 per cent) did no egg drop occur, while in 59 fully-vaccinated flocks 20 per cent dropped to nil and 17 per cent showed no drop. Remembering that many flocks must also have been exposed to disease without becoming clinically affected, these figures manifest a large measure of success for the vaccine.

Infected birds manufacture and discharge virus. Under the slaughter policy a large number of secondary outbreaks frequently resulted from disease in large intensive units, and this happened in spite of slaughter being carried out at an early stage in the disease. Under the new policy the number of secondary outbreaks from such units, now vaccinated, is much reduced.

The reason for this is that not only do many vaccinated flocks in the area resist infection, but also that vaccinated flocks produce less virus than unvaccinated flocks. Thus, since the vaccinal protection afforded by Newcastle disease vaccines is always relative to the amount of challenge, the success of the vaccination policy rests to a great extent on having a large proportion of the poultry population vaccinated. Only then will the full smothering effect of vaccination be felt on an area basis and the amount of virus be reduced to such an extent that most flocks will escape disease.

Maternal immunity passed to the chick

One feature to be taken into account in the vaccination of young stock is the presence of maternal immunity passed via the egg from the immune hen to the chick. This is a defence mechanism of nature and is not peculiar to hens nor to Newcastle disease. The degree of protection passed to the chick varies with the degree of immunity present in the hen and arises either from vaccination or from natural infection. It reduces as the interval from the time of vaccination or infection increases. This passive immunity in the chick cannot be relied upon to give protection against a heavy field challenge. It begins to wane from the day the chick is born, but it is maintained at a fairly steady level for 10–12 days and thereafter reduces more quickly until it disappears on a flock basis, generally at about 21 days, although in chicks from a flock recently exposed to natural infection it may last a week longer.

Maternal immunity interferes with vaccine 'take'. Chicks from hens with little or no immunity can be vaccinated successfully at least a week earlier than chicks from hens which have had a full course of vaccination. Manufacturers of vaccine therefore recommend that the first dose be given at 14–21 days to cover these variations. However, since most breeding flocks are fully vaccinated, the best time for most chicks is now probably around 21 days. Since maximum protection takes 10–14 days to develop, chicks vaccinated at 21 days will be 4½–5 weeks old before they can be regarded as fully protected.

The need to adopt routine sanitary and security measures to protect the young chick from infection until it has full benefit from vaccination is therefore apparent.

Secondary infections

Intercurrent disease is often of major importance in both vaccinated and unvaccinated flocks. An outbreak of Newcastle disease puts a stress on a flock and may light up intercurrent infections which are present in a mild or latent form; and losses from these secondary infections are frequently greater than those from Newcastle disease. The need to control such infections, which are becoming more prevalent under modern systems of intensive husbandry, is therefore being high-lighted and measures for their control must become routine practice under such systems. If this is done and vaccination against fowl pest is widely and regularly practised, the losses recorded above can be much reduced.

After graduating at the Royal (Dick) Veterinary College, Edinburgh, and Edinburgh University, the author of this article, **J. W. Simpson, B.Sc., M.R.C.V.S.**, joined the Ministry of Agriculture in 1935. After extensive field service in England and Wales, he was posted to Headquarters in 1960 and is now a Regional Veterinary Officer in the Animal Health Division, Tolworth.

When farm income is not sufficient to provide a living, part-time farming supplemented by some other job may be the answer. The School of Agriculture, Cambridge, has been looking into this question locally, and Mr. Popplestone, who has been associated with that investigation, here gives his views

When farming is not enough

H. G. Popplestone

THE reward of many farmers is below the wage of a farm labourer—that is, after making some allowance for a return on capital and payment for their organizing work. The Farm Management Survey gives the average income for farms below 50 acres in England and Wales for 1961 as £649, compared with an average of total earnings for agricultural labour of £622, and so many small farmers with less than average incomes earn less than farm workers.

But the income a farmer gets has to fall considerably before he considers doing anything about it. This is understandable when one considers how immobile farmers are, simply because of the limitation of farming as a training for other work. Few industrialists are interested in employing farmers who have passed middle age. And even the jobs that require little skill or knowledge involve routines that are quite different from those on the farm. Taking an off-farm job is about the last step that the average farmer would be likely to take if his income falls. Many steps come before this one.

Facing up

After a bad year, or a series of bad years, his first step would be to look into his cropping pattern to see whether he could substitute a more profitable crop. In parts of the Fens such a possibility might be very great; there are a number of crops (carrots, celery, onions, strawberries, mushrooms, flowers) which could be introduced in a small way to supplement a farming income, provided there is the time to give these crops the intensive care they need.

An alternative step would be to increase the size of the holding, either by buying the odd field if it came on the market or by renting a bit more; and this is done widely in the Fens, where there is a tradition of holding small pieces of land and perhaps renting it out to a small farmer. But for this capital is needed. So generally it is the small farmer who is already fairly successful, who is likely to be able to increase his holding. Many occupiers with small farm businesses have strengthened their position by the benefit of capital grants and management advice obtained under the Small Farmers Scheme.

Another possibility is to lower the standard of living—and this often seems to happen on a family farm, where the farmer has struggled all his early married life to find a living for his family but has at last recognized that he is not doing very well. But at this stage of his family cycle it probably doesn't matter, since his children may already be out at work and his needs are decreasing in any case.

Another way is merely to wait in hope that next year will bring better rewards, and often his hopes are justified. Many farmers getting poor prices over a number of years have been on the point of doing something about it, when their incomes have risen because of a bumper crop. They forget all about their troubles for another few years, and stay on. Some of the farmers interviewed in our Cambridge study, during a week when very poor prices were being paid for their gooseberry crops, said they weren't worried—it had happened before and they had weathered the storm, and they supposed they would manage again this time.

Bowing to the inevitable

Of the farmers who do leave or look for other work, not all are forced out because of very low incomes. Compared with their (small farmer) neighbours, they may be doing reasonably well. They seem to leave prematurely. In fact, farmers who do leave can be divided into two fairly distinct groups. In one group there are the farmers who are recognized by the community as poor farmers—the ones who cannot really cope with all the decision-making in farming today—the poor managers. These are the ones who are likely to take up manual jobs elsewhere, either working for another farmer and tending their farms as a sideline, or else making the complete break, and working, say, as a lorry-driver or as an unskilled building labourer. Usually the basic pay in this sort of job is not enough to give them an income which they regard as a reasonable full-time wage. So they have either to sell or rent out their land and take on overtime in their new jobs, thus making a decent wage, or continue to farm their holdings part-time and struggle with too much work and lower overtime rates, but making more than when they farmed full time. For this sort of farmer, part-time farming is a transition from farming to outside work, and eventually the farm may be sold up. Their status is the same as that of agricultural workers who have moved out of farming.

Success with two jobs

The others taking outside jobs are the more enterprising farmers who went into farming originally because of the challenge it presented but who have slowly realized that farming has not paid them the financial reward they had hoped for. They are still no closer to their dream of a 200-acre

farm than they were when first they began farming. They may have been reasonably successful as farmers, but this is not enough. It is this type of person who is more likely to hold on to his farm, working it during the evenings and at weekends, as well as holding down a job (and most of them have full-time, rather than part-time, outside jobs). Their sort of off-farm jobs are more skilled than those in the other group, and consequently better paid. And so they have less need of the money from the farm to supplement their incomes.

One farmer we interviewed, who now works as an agricultural demonstrator and has more than doubled his basic income, has kept his farm with a three-crop rotation (he got rid of his poultry) and is putting out all his farm work to contract. His farm income goes to provide luxuries for the family—items which they had never before been able to afford.

This solution may be the ideal, and perhaps many farmers find that both incomes are just sufficient for their needs. But they are more likely to make a go of the full-time job as well as farming their holding, than the other group of part-time farmers. In many cases, their wives take over more responsibility. In the Fens, wives often work on the farms, especially at hoeing and harvesting time, and many work casually on other farms.

The two interesting questions about this group of part-time farmers are: why they leave farming well before other farmers do, and what it is that persuades them to move into other jobs. Unfortunately, very little is known yet about this, but the significant factor may be that it is this group of farmers who tend to be more enterprising in their use of new ideas in farming and who are more realistic in their assessment of which crops are making profits and which are losing money. The farmers interviewed in this group so far have made greater use of the advisory services too. Another point is that these farmers seem to have higher aspirations than their fellows, and this seems to be related to such factors as education, status in the Armed Forces during the war, influence of non-farming relatives, etc. But it is difficult yet to know whether age is more important than the other factors. Most studies point out that farmers generally move into other work before they are 45, and very few indeed move out after reaching 50. A study in Yorkshire found that 70 per cent of the part-time farmers were between 30 and 50. The ways in which they come to hear about jobs seem to be diverse but many find them through their friends or by direct contact (in the case of jobs with agricultural merchants especially) with the firm concerned.

Farming by proxy

Like many other situations, part-time farming has its difficulties. First, the part-time farmer is short of time, often he has to work at weekends or in the evenings, and he does so, not only after putting in full time at a different job, but after spending part of the day travelling. His total working week is therefore much longer than that of a person working full time with average overtime hours.

In consequence, he is likely to have less time for attending meetings with neighbouring farmers and less time to consult the advisory services. So in the long run his farm is likely to suffer. His wife will have more responsibility for making decisions on the farm, dealing with representatives, etc. So he is farming by proxy. He has to remind his wife what needs to be ordered,

what to tell the vet. when he calls, etc. And he may find this difficult if he is to keep his status as head of the household. Last, because of his shortage of time, he will have less time available for his family—he is becoming more the wage earner and less the family head.

Perhaps the difficulties involved in holding down two jobs provide the clue to why the progressive small farmer is more likely to adjust well to part-time farming, rather than the average small farmer. Perhaps this is the answer to his need of a job with plenty of challenge, but at the same time a job adequately rewarding for the effort he has to put forth.

The Ministry's Publications

Since the list published in the October, 1964, issue of *Agriculture* (p. 478) the following publications have been issued.

BULLETINS

No. 144. Beehives (Revised) 3*s*. (by post 3*s*. 4*d*.)

This new edition includes much information that is not available elsewhere within a single cover. It should prove must useful to established beekeepers and invaluable to newcomers in their choice of hives.

No. 198. The Small Poultry Flock (New) 3*s*. 6*d*. (by post 3*s*. 10*d*.)

Sets out the policy to be followed for obtaining the full advantages of poultry keeping on a small scale, with information and advice on all aspects.

ADVISORY LEAFLETS

No. 295. Mastitis in Cattle (Revised)

No. 387. Laying Cages (Revised)

No. 532. Fruit Tree Tortrix Moths (New)

FARM MACHINERY LEAFLETS

No. 6. Mouldboard Plough Setting (Revised) 6*d*. (by post 9*d*.)

OTHER PUBLICATIONS

Report on Safety, Health, Welfare and Wages in Agriculture, 1st October 1962 to 30th September 1963 (New) 1*s*. 9*d*. (by post 2*s*.)

Review of the Persistent Organochlorine Pesticides. Supplementary Report by the Advisory Committee on Pesticides and other Toxic Chemicals (New) 1*s*. 3*d*. (by post 1*s*. 6*d*.)

Single copies of Advisory Leaflets, up to a maximum of six different leaflets, may be obtained free from the Ministry (Publications), Government Buildings, Tolcarne Drive, Pinner, Middlesex. Copies beyond this limit must be bought from Government Bookshops (addresses on p. 542), price 4d. each (by post 7d.). Other publications are obtainable from Government Bookshops, from Divisional Offices of the Ministry or through any bookseller.

Watercress around Salisbury

T. A. Owen

A LARGE part of the 80 or so acres of watercress being grown in Wiltshire is to be found around Salisbury, in the chalk valleys of the rivers Ebble, Nadder and Wylye. The industry was started here about ninety years ago in the parish of Broadchalke by growers who came from Hertfordshire. Undoubtedly, it was the means of quick transport offered by the coming of the railways that was largely responsible for this migration from the home counties and the development of watercress growing in Wiltshire and Dorset.

The early beds were made the 'hard way', entirely by manual labour using picks, shovels and barrows, the workers wearing leather high-boots and with their trousers strapped or tied at the knees, and quenching their thirst with free cider supplied in wicker-covered stoneware jars. Once established, the industry spread to surrounding areas wherever there was enough water, either as natural springs or by sinking artesian wells or boreholes.

The water

The water in this area comes from the chalk and being alkaline is particularly suitable for watercress growing. Its supply, however, both from natural springs and boreholes, fluctuates during the year—especially that from boreholes, where the supply varies from quantities far in excess of requirements during the winter (when it has to be controlled by valves), to the point of failing to break surface in the summer and has to be pumped out. Some bores, although able to supply all needs, fail to break surface at any time of the year, so that the pumps have to work continuously.

All the cress in the area is grown in water derived in the first instance from underground sources. This is important, not only from the point of view of cleanliness, but also because such water has a constant temperature of around 50°F at source; this has an important bearing on cropping during the winter months. As the water passes through the beds it cools and is collected into a stream, then used again in cropping beds lower down.

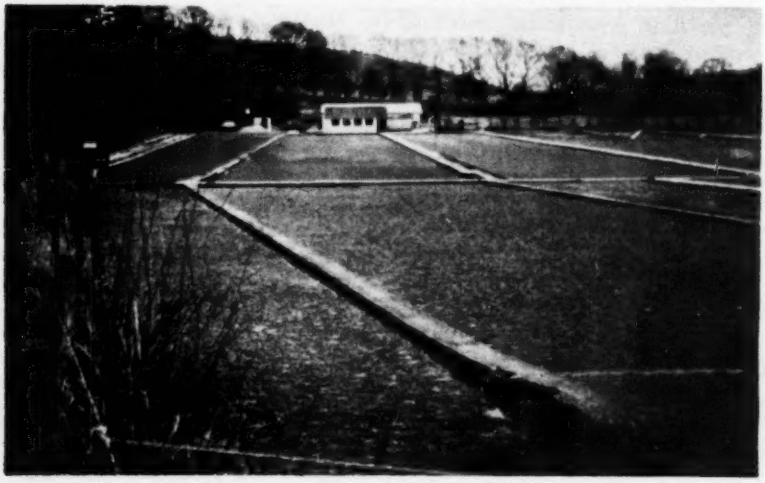
In contrast with watercress beds in greensand formations elsewhere in Wiltshire, those around Salisbury are naturally 'hard bottomed', making them easier to work and allowing the use of tractors and machinery where necessary.

Green cress ousts brown

In common with many other horticultural crops, the production and marketing of watercress has undergone a number of changes during the last decade, and these are clearly reflected in the holdings seen around Salisbury. One of the most important is the propagation of cress from seed at regular intervals instead, as in the past, of relying entirely on vegetative methods. This has become necessary to counter the spread of viruses and other diseases attacking the crop, and has led to a reduction in the area put down to brown cress.

In the early days of the industry brown cress was a great favourite; it was more hardy than green and had reputedly the 'true cress flavour'. It did not grow out of the water so much and, being virtually a non-seeding hybrid, it caused little or no trouble by running to seed, as do the green types. In the late 1940s the so-called 'crook root' disease became a serious problem on many holdings, and this, together with the virus disease present in most vegetatively produced stocks, led to the greater use of seedlings as a means of restocking. Green cress seeds freely and seedlings are, at the outset, free from virus. For some years growers have been selecting their own strains, paying particular attention to leaf size, colour and lateness of flowering.

Watercress beds at Coombe Bissett, near Salisbury, on a site well sheltered from the north-east



Crook root

The disease known as 'crook root', whilst most probably always present to some degree in watercress beds, became serious shortly after the war. Investigations were carried out at a number of centres on its cause and control. The organism responsible was found to be one closely related to that causing club root in brassicas. The roots of the plants become curled or twisted and growth may be severely restricted; in some cases the plants are killed. The direst effects of the disease occur during the winter, when weather conditions are at their worst and the plants lacking in vigour. The disease may be controlled by using zinc frit or sodium hypochlorite, the latter being more commonly used in the Salisbury area following work on the local holdings by two N.A.A.S. officers, L. J. Hooper and B. B. Till.

Alternatively, a zinc sulphate solution can be used, dripping the material on to the beds near the water source, but this is less popular in the Salisbury area, since it involves accurate measurement of water passing through the beds, and this is often difficult.

Whichever chemical is used, the treatment must be looked upon as complementary to good cultural methods. An ample supply of water is the most important requirement.

Towards better marketing

Watercress production has its peak in the spring and early summer months, but the crop goes on almost all the year round. Deterioration quickly sets in during transport, so that marketing is tricky during the summer months. Many growers in the area counter this by removing 'field heat' from the cress by hydro-cooling. The chips of bunched cress are passed slowly through a tank of circulating water which is cooled by a refrigerator unit. Crushed ice is then added to the chips before lidding, so that the cress starts its journey to London, the Midlands, Bristol and the main provincial markets of South Wales and the North in the best possible condition.

Scope for new methods?

Whilst, to some extent, much of the heavier work of clearing out and treating beds has been mechanized, many of the methods of growing and harvesting watercress are still traditional. Much thought is being given by growers to streamlining their operations, particularly in the packing sheds, but naturally the relatively small size of the industry is against the development of much specialized machinery. However, the costs of labour, packing and transport continue to rise, and this is certain to stimulate interest in any equipment which will reduce the cost of production. There is little co-operative buying and marketing at the present time but, as with other sections of the horticultural industry, developments on these lines must be considered in the future.

The author of this article, **T. A. Owen, B.Sc., N.D.H.**, has been the N.A.A.S. County Horticultural Officer for Wiltshire since 1957. For the previous 11 years he served in a similar capacity in Carmarthenshire. When Mr. Owen first left school, he was engaged in practical market gardening at the Glamorgan Farm Institute before going to Reading University, where he studied from 1936 to 1939. He was with Mr. F. A. Secrett on his holding at Walton-on-Thames for a while, and later became County Horticultural Instructor to the Carmarthenshire County Council.

Battery Muck is a problem

Charles Riley

speculates on the possibilities of

De-watering Poultry Manure

THERE are those who say that it is not possible to handle and de-water poultry manure. But looking at industrial processes in the U.K., I am sure it *can* be done. We already have machines which will dry poultry manure from 76 per cent to 20 per cent moisture at the rate of 7 cwt load intake per hour, and there is no doubt that these and other existing machines could be modified to meet the particular needs of a poultry holding. The only questions are, how cheaply the job can be done and if it would be possible to do it regularly throughout the year.

The main factor in the cost would probably be the depreciation and interest on capital, rather than the actual cost of the fuel for drying; also on the mechanical side the two chief problems are to get the muck from the birds to the drier at a constant rate of in-feed and, when the muck enters the drier, to present as large a surface area to the drying medium as possible.

Before looking in detail at purely poultry problems it is interesting to glance at methods of handling human sewage. Here we find one or two interesting parallels. There are many methods for dehydrating sewage sludge, and it would appear that no particular one is pre-eminent. In addition, even where sludge is composted with other waste and a useful compost type of fertilizer is produced, this process is not self-supporting financially. We cannot therefore expect either a quick answer in the terms of the best possible method nor an easy wicket as far as the cost of the job is concerned.

Putting a value on it

What then are we looking for? It may be suggested that we are seeking a method of converting an unpleasant and difficult-to-handle product which often cannot be given away into a 'cake' which can be handled and

easily given away. Once this point is reached there will be hopes of translating a give-away into a sale; and there is no reason why such a material should not sell readily, provided it is marketed properly.

The various statements published about analysis and even the quantitites of fresh poultry manure produced from battery birds have not been at all consistent. As a convenience, I suggest that 1,000 birds in cages will produce between 1½ and 2 tons of fresh manure per week, at about 76 per cent moisture, and that a cubic yard of such manure will weigh in the region of one ton. These figures will of course vary with temperature, time of year and size of bird. Assuming that this material can be dried to 20 per cent moisture, one then naturally attempts to price it and concludes it is worth what you could sell it for! In a speculative vein I suggest that the cost per ton of dried product should not exceed £10 (including depreciation, etc.) and if suitably packed it should be possible to find a market that would cover this production cost. I have mentioned 20 per cent moisture as a final figure; in fact my colleagues and I started thinking in terms of 10 per cent as being stable, but the product becomes very dusty and it is probable that, using the minimum heat for drying, a figure of between 20 and 30 per cent is more likely to permit reasonable storage without heating and a fair sample for spreading.

On the surface poultry manure resembles other types of sludge but its response to mechanical de-watering agents is different—due probably to its physical structure. A machine which can comfortably extract water from cow manure may fail completely when presented with battery muck. I have been trying out poultry manure in various de-watering appliances during the past few months, with the following results. On centrifuge, some water was yielded with peak revs but thereafter failed to flow. Trials with a filter press and a vacuum filter gave the same sort of results, and some recent German tests with a screw press finished with a revolting mess and very little water extraction. Whilst therefore one cannot at this stage, dismiss these industrial processes without further work, it is obvious that there is as yet no quick and easy answer.

Wanted — a drying plant

Obviously, the material can be dried under heat, and electricity, oil or gas can be used. Rough trials have indicated that the use of electricity alone is far too expensive. I have seen both gas and oil used effectively, and here it can be broadly said that whilst oil is the cheapest fuel, gas is cheaper in first cost and, from the point of view of the farm staff, probably easier to maintain.

As horse-power is cheaper than heat, I had hoped to find a simple two-stage method, getting most of the water out by mechanical means and then drying the residue, but at present it looks as though this will not be effective with neat battery manure. But where water has been added and a slurry is made in a tank, then it may well be possible to use a vacuum filter or other mechanical means to reduce a slurry from 95 per cent moisture to the region of 70 per cent, but it seems unlikely that it can be reduced below that within reasonable costs.

If this method is adopted, then of course an effluent will be produced which under some circumstances can be as difficult to get rid of as the original manure. It may be possible to divert this into a local sewage unit,

but it is worth noting that whilst Local Authority engineers seem very willing to discuss this possibility, they are not always in a position to accept it simply because in some areas sewage works are working nearer peak load than in others. But it is certainly worth while making inquiries.

Among problems previously mentioned is that of feeding the manure into a drier or some other appliance. This needs a lot of thought, because to run a drying plant efficiently a constant in-feed is needed so that heat and the air flow may be balanced, and it is obvious that whilst a conveyor can easily take neat poultry manure direct from a group of houses to a drier, this must be metered and the load controlled in some sensible manner. Obviously, one could not afford to design a drying plant where a gigantic conveyor delivered all the droppings within say an hour. Arrangements would have to be made to empty a tier or a block of cages at a time so that a constant input could be maintained. Alternatively, it may be thought desirable to run a drying plant for a fixed time of day or number of days or part of days per week, and here the droppings would have to be collected into some form of container and then fed to the drier. It is probable that these semi-solid neat battery droppings could in fact be pumped from such a container to the drier, and this would appear to have many advantages—especially as it would enable the cleaning of blocks of cages and the drying of the manure to proceed independently if so desired. Whilst this could be done with neat manure, one of the advantages of adding water is that it is possible to pump this slurry and meter for de-watering.

Recap.

Very little is known about the de-watering of poultry manure but rough trials indicate that normal industrial appliances do not handle it very well. In the short term a quick answer appears to be drying by heat.

It is suggested that the dried product should be produced at not more than £10 per ton, and at this price it may offer the possibility of resale. The N.P.K. content has a value in the region of £7 or £8 per ton, and there is of course a most useful organic content which should certainly not be lost sight of when directing sales towards the industrious surburban gardener.

The material appears to store well in polythene sacks, and it may interest even large arable growers where poultry are kept in large numbers on the same farm.

At the moment some farmers are anxious to dry battery muck but are reluctant to invest a considerable sum in a relatively untried drying plant. On the other hand, plants do exist which will undoubtedly make a satisfactory job, once the teething problems of handling the stuff are overcome. The sooner somebody takes the plunge and these parties are brought together for some large-scale practical work, the sooner we shall have more definite information on this most interesting subject.

Charles Thomas Riley, N.D.P., had already had a great deal of experience with poultry when he joined the National Agricultural Advisory Service after the war. He worked in Northamptonshire and Hampshire before being appointed Director of the Phoenice Poultry Progeny Testing Station at Great Bookham, Surrey, in which capacity he served until September of this year, when work at the station ceased. He is now specialist in poultry manure and waste problems in the N.A.A.S. at Guildford.

Pellets or meal?

Mills, Mixers and Cubers

M. N. S. Henderson

•

A. J. Bradshaw

NEW methods of livestock management plus an increased home production of cereals have encouraged many farmers to consider installing their own equipment for feed preparation.

The initial and operating costs of such equipment favour the larger livestock unit. Grinding whole grain is relatively inexpensive; small automatic hammer mills with low horse-power motors can handle and satisfy high yearly requirements. These machines should be sited close to the whole grain store. Weighing of the grain or measuring with calibrated hoppers is preferable to systems where the meal is measured, since this greatly reduces the dust problem. Meal should be blown to the mixer or meal bin adjacent to the mixer. Taping the joints will ensure that the meal pipe has no leaks. A filter cloth of adequate size (10 sq. ft per mill h.p.) should be fitted at the receiving end, and this must be cleaned regularly to avoid loss of output from the mill.

Mixers with vertical worm- or chain-mounted slat mixing mechanisms will meet most requirements. Any very small quantities of additives should be pre-mixed, particularly for poultry rations. A complete protein concentrate is generally preferred to mixing 'straights', and avoids weighing small quantities of minerals, etc. The capacity of the mixer governs the batch size, and care must be taken to install a machine large enough to meet particular needs. A 10-cwt model can satisfy a demand of 6 tons per week in 12 batches, but it might well be easier on the labour organization to have a 20-cwt unit requiring only six batches. The mixer should be placed so that there is adequate room around it for protein concentrates and, if the produce is to be sacked up, for the mixed rations, prior to being distributed to points of consumption.

If a cuber is required it can be fed either direct from the mixer or from a revised meal bin of special design, having two sides at 60 deg. and two at 90 deg. to the outlet. Cubers of the farm type rely entirely on pressure for binding the meal. It is difficult to bind very dry meal, and the addition of water or a binding agent such as molassed palm kernel meal, molassed brewers' grains or molassine meal may be necessary. Binding agents tend to be sticky in the mixer but their use does materially help to form a cube which will accept normal handling without breaking up. Cubes should not be left in bulk without adequate cooling but provided they are sacked within a few hours no special cooling equipment is needed.

A unit marketed in recent years dispenses with the mixer by measuring both whole grain and protein direct into the mill, from which it is conveyed into either a meal hopper or a cuber.

Many farmers prefer feeding crushed grain to certain classes of livestock. To get a satisfactory dust-free crushed product, the grain should be above 18 per cent moisture. Water may be added to dry grain a day or two before rolling to increase its moisture content, or a steaming device may be used; but it does seem strange to go to the expense of drying grain only to wet it again. There is now considerable interest in the storage of high moisture grain in air-tight silos; but that is another subject.

The likely costs per ton of each operation—single and collective, will be seen from the figures below. (No allowance has been made for general farm overhead costs.)

Cost of Processing Various Quantities per year

Cost per ton at:	Mill	Mixer	Cuber	Wiring
	£ *s.* *d.*	*s.* *d.*	£ *s.* *d.*	*s.* *d.*
250 tons per year				
*Operation	5 6	1 6	9 0	
†Annual	4 6	3 0	10 2	1 0
£1 14*s.* 8*d.*	10 0	4 6	19 2	1 0
150 tons per year				
*Operation	5 6	1 6	9 0	
†Annual	7 6	5 0	17 0	1 9
£2 7*s.* 3*d.*	13 0	6 6	1 6 0	1 9
100 tons per year				
*Operation	5 6	1 6	9 0	
†Annual	11 3	7 7	1 5 6	2 7
£3 2*s.* 11*d.*	16 9	9 1	1 14 6	2 7
50 tons per year				
*Operation	5 6	1 6	9 0	
†Annual	1 2 6	15 2	2 11 0	5 2
£5 9*s.* 10*d.*	1 8 0	16 8	3 0 0	5 2

*Operation includes labour, wear and tear, and electricity running costs

†Annual includes depreciation, interest and electricity connected load charge

22. Ross-on-Wye, Herefordshire

A. M. Salkield

UPLAND sheep on rough grazing at 1,200 ft; hops, blackcurrants and 'fancy grade' dessert apples. These two groups may not present the absolute extremes possible in British agriculture, but they illustrate the diversity within the Ross area. The district occupies the south-east corner of Herefordshire, with the Wye entering at Mordiford in the north and meandering, in all her moods, southwards down the Wye Valley by Ross-on-Wye to enter Monmouthshire just below Symonds Yat.

The geology of the district is uncomplicated. It is largely composed of Old Red Sandstone giving rise to red soils, generally classified as light to medium loams. The Wye Valley itself has a deep alluvial soil. Two areas, older geologically, occur at Woolhope in the south-east tip of the district. Both these areas are on the Silurian, resulting in two general soil types—a heavier and sometimes poorly-drained soil or a thinner soil overlying shale. The change from Old Red Sandstone to Silurian is often startlingly well defined, especially on newly-ploughed land. Rainfall is about 28 inches, increasing on the higher ground towards the west.

Ross-on-Wye is a pleasant market town, with agriculture and summer tourists as its main concern, though some light manufacturing industry is beginning to develop.

Within the district there are several well-defined areas. To the south and south-east of Ross is a small part of the Forest of Dean, with which should be included the upland limestone area known as The Doward. Here the farming is mostly small-scale, with a mass of tiny fields held in a matrix of 'green' lanes. There are a few dairy farmers here, but also many part-timers rearing calves, with two or three sows for weaner production and perhaps a deep litter house.

The Wye Valley itself forms another area, in which are found larger arable farms, growing barley, spring wheat, sugar beet (for Kidderminster), and potatoes, plus Hereford cattle being finished on the riverside grazings or in foldyards. Here the land is rich and yields are high, farmhouses large with generous barns, and yards with an air of spaciousness.

Where the valley widens and the deeper alluvial soils are left behind, more intensive arable farming is carried on, especially on the sandy loams of the Old Red Sandstone. In the past, lack of water has dictated an intensive arable system with all its attendant problems. Changes are taking place;

folding the sheep on green crops ('root-tegs') is now much less common, and the one-year ley based on Italian ryegrass and Broad Red clover is giving way to the longer ley. If local farming lore could be summed up in a few words they would be conservation of moisture, early planting, and look after the potash. Along the valley, fruit, malting barleys and blackcurrants are grown on quite a large scale where soil depth and frost-free locations permit.

To the east, and the Gloucestershire border, the land rises gently out of the valley, becoming rather 'stronger' with an increased clay fraction. Grass grows well here and withstands drought better. Although arable crops (not forgetting hops) are grown, more stock are carried—for dairying and (Hereford) cattle breeding. In the north-east corner of the district lies the Woolhope Dome, where the Silurian-derived soil again changes the character of the farming. The Dome itself is remarkable for its geological symmetry, rising from the Wye Valley on the west side and topping the 850-ft contour at its highest point, then dropping on its eastern side down to the Roman road at Little Marcle. Hops, in association with pedigree Hereford cattle, winter wheat, winter oats and in some cases blackcurrants, characterize the farming on the lower fringes of the Dome where the Silurian merges with the Old Red Sandstone. Slightly higher, mixed farming prevails—winter cereals some winter beans, more permanent grass and beef cattle. Dairying is interspersed at all levels, though farms tend to be smaller on the higher ground because of the social-cum-agricultural problems currently associated with this class of holding.

The land lying to the west of the Wye Valley rises gently and is more open, with less woodland. At first, the soil is a light loam growing a wide variety of crops, excepting hops. Barley is the main cereal, including some of good malting quality. Sheep, although found in all parts of the district, are carried in rather larger numbers here. Top fruit and blackcurrants occur on many farms, as well as market gardening crops. There is no really characteristic cropping or farming pattern in this area. Its characteristic is perhaps its variety, illustrated by the different ways in which individual farmers make use of the potential that their land offers. The main limiting factor is the fairly low rainfall, coupled with a light soil that tends to dry out quickly.

Further west the land rises rather more steeply; up to 1,200 feet on Garway Hill, Sheep, beef cattle and the ubiquitous dairy cow are the main stock. Cereals are grown as cash crops, barley, and both winter and spring wheat. Spring oats are less common. Many of the holdings are small, though this is by no means the general rule. Typical stocking and cropping are calf rearing, sheep (often Cluns crossed with Radnors or Kerrys), a few poultry and (more rarely) two or three sows, 2 or 3 acres of roots, some leys where ploughing is practicable, otherwise permanent grass of variable quality.

The opportunity for part-time activities is less here as, apart from the traditional 'a day's hedging', help with dipping, ditching, etc., there is no alternative source of employment within reasonable reach, except possibly in Hereford. This tends to accentuate the shortage of capital. Family relationships are of great importance and lead to mutual help with machinery and labour at peak periods. The smaller farms often remain in the same family for several generations.

Nature has been very generous in many parts of Britain, but surely never more so that in this part of a beautiful county.

N. B. WOOD
Agricultural Land Service, Bristol

Effluent Tanks

THE farm pond, artistically depicted with the wagoner watering his horses after the day's work, used to be a traditional part of the homestead scene. It also fulfilled a useful purpose besides the watering of stock, especially if it had an overflow to a nearby ditch. When no longer required for watering horses it became a convenient dumping place for the equally unwanted horse-drawn implements, and drainage ran unimpeded along the ditch. Recent anti-pollution laws have caused many a regretful eye to be cast back towards the old farm pond.

When, after considering all the alternatives, it is decided to handle dung in a liquid state, some form of storage tank will be needed. Size will depend upon the skill employed to keep the amount to a minimum and how often the tank can be emptied. Even though the effluent arrives at the storage point as a liquid, it can still be handled as a solid by having a compound of straw bales as blotting paper. But if it is to be handled as a liquid, then there are degrees of elaboration for effluent tanks.

The simplest form is our old friend the hole in the ground, be it called farm pond, lagoon or blind ditch. Maybe the soil is not self-sealing; immediately there is the danger of pollution to watercourses by underground seepage. There are flexible materials on the market which can be used as liners. These are generally plastic sheeting but need to be tough enough to stand up to root growth, subsidence and to be chemically inert to effluent. The situations where a simple hole in the ground meets all the requirements for effluent storage are few. Usually, something of a more permanent nature has to be constructed which does not add to the problem by collecting rainwater or subsoil water and is not a source of nuisance or danger.

The storage of liquids involves constructional problems of withstanding internal pressures and sometimes external pressures from a high water-table. The larger and deeper the tank the greater the problem. So often these problems are dealt with the hard way. Elaborate forms of construction are used which are hard on the pocket; or perhaps the construction is over-simplified and the tank is a failure—which is even harder on the pocket. It is false economy not to have expert advice on the construction of these tanks.

Nature has decreed that liquids are happiest when allowed to take up a simple cylindrical shape. Forced into rectangular shapes, liquids spend their time trying to turn the rectangles into circles. Why not make life easier by having circular tanks whenever possible? Again, when faced with rocky soils or with a high water-table, why always think in terms of digging holes? Manufacturers can supply pumps, augers or other forms of conveyors which will elevate farmyard effluent. If it is all stored below ground it has to be got out at some future date. On these difficult sites it is better to have a small, shallow pit into which the effluent is scraped or piped, and to have some form of mechanical elevator to an above-ground circular tank. On sloping sites it is generally cheaper to have a series of circular tanks down the hillside, connected by short lengths of dip pipes.

Prefabricated concrete circular tanks can be obtained, with diameters up to 30 ft, in curved segments which are bolted together. A circular tank 24 ft in diameter need be only 3 ft deep to have a capacity of 8,000 gallons. Natural conformation of the ground can often provide a hollow of this depth, thus reducing excavation to a minimum.

For the small farm, ordinary concrete rings can be obtained in depths of 3 ft and with diameters of up to 6 ft. Each ring has a capacity of 500 gallons. Therefore four holes, each 6 ft $\times$ 6 ft, lined with rings and linked together, provide four thousand gallons of storage. After the rings are dropped into position, concrete floors can be poured into the bottom and railway sleepers will span the tops as covers. Tanks should be sited so that heavy traffic does not have to cross them. This is cheaper than trying to construct covers which will carry traffic, and certainly safer.

Another method of constructing circular tanks is by the use of self-centring fabric reinforcement. The reinforcing fabric has ribs making it self-supporting, and the mesh is fine enough to retain the concrete which is poured between two thicknesses of the fabric. The reinforcement can be bought curved to size, and after the base is laid reinforced concrete walls can be constructed without the need for any other shuttering.

Tanks above ground should always be circular for ease of construction and economy. Any of the methods previously described for circular tanks can be employed. Extra care will have to be taken with the sealing of the joints between the components, for obvious reasons. Plastic liners for this form of tank are available.

Although circular tanks have constructional advantages, there are circumstances where it is necessary to have rectangular tanks, e.g., where paddle agitators are to be used. It is now possible to buy prefabricated rectangular tanks, which are generally constructed of pressure-treated timber with sides and ends in single sections requiring jointing only at the corners. Cover units are also available, so that site work is reduced again to digging the hole, setting up the units, and casting in a concrete floor.

When constructing rectangular tanks, it is often an advantage to 'hopper shape' the bottom. This means having the width of the floor about half that of the cover, with the bottom half of the wall splayed. In this way less reinforced vertical walling is needed and costs are reduced. The shape also has the advantage of fitting better the action of the paddle agitators.

The storage of effluent is a matter of reduction. Reduce to a minimum the amount to be stored; then reduce to a minimum the number of component parts needed to construct the tank.

IN BRIEF

The Rt. Hon. Thomas Frederick Peart, M.P.

Mr. Peart, the new Minister of Agriculture, Fisheries and Food, was born 30th April, 1914. He took a B.Sc. degree at Durham University (Bede College), and was there President of the University Union Society. He also boxed for the University as a middleweight and played rugby and football. He played football for his county—Cumberland. Later he started to study law and became a member of the Inner Temple Inns of Court, but this part of his career was cut short by the war. In 1939 he joined the Royal Artillery and was commissioned in 1940. He served in North Africa and Italy.

Both Mr. Peart's parents were school teachers and he himself took up this profession, teaching in a Grammar School, before going into politics.

From 1937 to 1940 he was a member of Easington Rural District Council. He became prospective Labour Parliamentary candidate for Scarborough and Whitby and for Sunderland. He was elected for the Workington Division of Cumberland in 1945 and was chosen by the Rt. Hon. Tom Williams, as he then was, Minister of Agriculture and Fisheries, as his Parliamentary Private Secretary. He served in that capacity from 1945 to 1951. When the Labour Party went into opposition he became chief spokesman on science and then agriculture. He was the first backbencher to be called by Hugh Gaitskill to lead in a major debate—on education. He was Chairman of the Parliamentary Labour Party's Education Committee, then Science Committee, and Atomic Energy Committee, which he started, and of the Labour Party's Agricultural Committee. He has taken a considerable interest in all matters affecting the agricultural industry both here and overseas.

He was the British delegate and representative for agriculture on the Council of Europe. He led mixed delegations to study agricultural problems and the absorption of refugees in Italy, Greece and Turkey, and reported on this to the Council of Europe.

In this country he has been the Privy Council representative on the Council of the Royal College of Veterinary Surgeons and Nature Conservancy.

Mr. James H. Hoy, M.P. and **Mr. John Mackie, M.P.,** have been appointed as Parliamentary Secretaries to the Minister.

Early Potatoes with and without Irrigation

A trial, carried out by the N.A.A.S. in co-operation with the National Institute of Agricultural Botany over the last three years at Orchardleigh Farm, South Petherton, Somerset, has provided valuable information on the behaviour and rate of bulking of early potato varieties, with and without irrigation.

Half the trial area received irrigation and the other half was not irrigated.

The two parts of the trial were separated by a buffer area to avoid the possibility of irrigation drift and seepage. Applications of water were made as necessary whenever the soil moisture deficit appreciably exceeded one inch from the time the plants were 3–4 in. high. In 1962 4·8 in. of water was applied between 28th May and 27th June, and in 1963 4·05 in. between 1st and 18th June. In 1964 1·25 in. applied on 14th May proved sufficient. Lifting was carried out on four days (usually one week apart).

The weather over the three-year period has been variable. In 1962 total rainfall during the time the crop was in the ground was 4·75 in., of which only 0·27 in. fell in June. In consequence the response to irrigation was spectacular and averaged 43 per cent over the lifting period. In 1963 rainfall during May and June was only 3 in., and of this 1·25 in. fell in the last four days of June. The average response to irrigation over the lifting period was 21·5 per cent. In 1964 rainfall in April and the first three weeks of May was only 1·98 in., but after that time no further irrigation was required. The average response to irrigation was 16 per cent at the first lift, but no benefit was seen later on.

Irrigation would have paid handsomely in 1962 and 1963. An increase of 1 ton per acre is likely to be profitable if 3–4 in. are applied to early potatoes during the season. The average increase in yield over the two years was 3½ tons.

The following impressions of individual varieties are noted:

CRAIG'S ALLIANCE has done consistently well as a first early variety, which can be left to bulk as a second early. It responded well to irrigation in 1963 and 1964 over the first three lifts.

HOME GUARD did well in 1963 and 1964 as an early bulking variety. It responded well to irrigation in 1962 and 1963 over the first three lifts.

ULSTER PRINCE has given an attractive sample in each year and bulked reasonably early in 1963 and 1964. It responded well to irrigation in 1962 and 1963.

ULSTER PREMIER has been disappointing, although it gave a good yield at the first lift in 1963.

ARRAN PILOT did extremely well in 1962 over the whole lifting period. It remains an excellent dual-purpose variety, but its response to irrigation was moderate.

CRAIG'S ROYAL has been slow to bulk and has usually been well behind Craig's Alliance throughout the lifting period.

(We should like to express our gratitude to Messrs. D. J. Vaux and Sons for their wholehearted co-operation throughout the trial period.)

T. M. Telford

A Lettuce Experiment

The National Vegetable Research Station has been trying out the use of fertilizer dissolved in irrigation water on outdoor lettuce. Since both irrigation and dry fertilizer (especially nitrogen) may be necessary during growth to get a satisfactory yield, the possibilities of combining the two operations would often be very worth while.

The variety chosen for experiment in 1960–62 was Borough Wonder. One experiment was carried out in a very wet season, one in a fairly wet and the other in a dry season. No significant difference in the mean fresh weights of lettuce resulted from the application of fertilizer dissolved in irrigation water compared with the application of dry fertilizer and irrigation separately. In one experiment these two treatments caused substantial differences in the numbers affected by *Botrytis;* the particles of dry fertilizer may have caused slight damage to the lower leaves, allowing the disease to enter through the lesions. This reduction in *Botrytis* infection might be an advantage in favour of dissolved fertilizer in years when the disease is prevalent.

The fertilizer was a mixture (equal parts by weight) of pure potassium nitrate and pure calcium nitrate; a fixed quantity was applied each week, and the concentration of the fertilizer solution therefore varied according to the amount of irrigation necessary. A total of 4 oz per sq. yd (approximately 11 cwt per acre) of fertilizer was given in 1960 and 1961, and a total of 2 oz per sq. yd in 1962. The water or dilute fertilizer solution used for irrigation was applied by pumping it from tanks through a hosepipe fitted with a fine rose.

The labour-saving potentiality of applying fertilizer dissolved in irrigation water exists only in dry years; in wet years, a top dressing of dry fertilizer may still have to be applied by other means. Commercial equipment for introducing a metered amount of concentrated fertilizer solution into irrigation lines is readily available for all sizes of installation, though it is not yet possible to switch automatically to plain water towards the end of each irrigation. On the other hand, by manipulating the controls of many diluters it is easy to arrange for them to 'run out' of fertilizer well before the end of irrigation so that one ends up, as one should, by applying plain water. This is necessary to prevent the corrosion which is liable to occur to metal irrigation equipment if it is left full of dilute fertilizer solution; it is not necessary to wash the fertilizer solution off the leaves of the crops. When fertilizer is dissolved in the irrigation water the evenness of its distribution depends on even application of the water; thus accuracy of irrigation equipment in achieving even water distribution is especially important if uniform crops are to be obtained.

This experiment is reported in greater detail in *Experimental Horticulture* No. 11, on sale at H.M. Stationery Office, or through any bookseller, price 6*s.* 6*d.*

New Tomato Tray

The first result of a development programme on new standard containers for horticultural produce, now being carried out by the British Standards Institution's committee on packaging of horticultural produce, is a new standard for *Non-returnable fibreboard tomato trays* (B.S. 3789).

Like the existing standards for a wooden tomato tray (B.S. 2892) and a fibreboard basket (B.S. 3200), the new publication assures tomato producers of a reasonably priced tray which can be relied on to get produce to market in satisfactory condition. In addition, it is designed to fit on the international standard pallet (40 + 48 in.) intended for horticultural produce.

Before the standard was finally approved, trays of this type were tried out by a grower handling substantial quantities, and his experience was used in the final drafting.

This is the first standard container specially designed to facilitate the pallet handling of horticultural produce. Others expected in the next year or so include those for dry packs and bulk packs of flowers, and for punnets and punnet trays for soft fruit.

Copies of B.S. 3789 may be obtained from the B.S.I. Sales Branch, 2 Park Street, London, W.1., price 4*s.* 6*d.* each (postage charged extra to non-subscribers).

An Introduction to the Study of Insects. DONALD J. BORROR and DWIGHT M. DELONG. Holt, Rinehart and Winston. £5 16*s*.

Although this American text-book has proved sufficiently useful to require a second edition, it is probably still not very familiar to British entomologists. This is a pity, because the book has much to recommend it. It is generally modern in outlook, clearly written and attractively produced. It is unusually well illustrated, and has many other useful features, such as a glossary, up-to-date reading lists, much information on collecting and preserving insects, and dichotomous keys to all the important families. There is even a short section on arthropods other than insects.

With so much to be grateful for, one regrets having to draw attention to the book's shortcomings. Firstly, it presents a highly-selective picture of modern entomology. There is very little discussion of, say, insect morphology, physiology, histology or ecology, and an almost exclusive emphasis on biology and taxonomy at the level of the family or super-family. About threequarters of the text is, in fact, a systematic survey of the families into which the twenty-six orders of insects are divided, and the few general chapters are not enough to restore the balance.

Then again, the book is very largely North American in its outlook and examples, so that the reader will often search in vain for a reference to some of the commonest European species. But perhaps its greatest drawback is that it tends to fall between two stools. It is surely too large and expensive a way of introducing the insects to non-entomological readers, and yet it is not sufficiently detailed or advanced in treatment to appeal as a reference work for the intending specialist. It may be of most value to the more advanced undergraduate zoologist, who will find in its lucid text and vivid illustrations a fresh and reliable restatement of those well-established aspects of the subject which still form the background of much entomological thought. Even so, such a reader will need to supplement the book from other sources, and he will probably prefer to borrow it from a library rather than buy it himself.

R.G.D.

History of British Agriculture, 1846–1914. CHRISTABEL S. ORWIN and EDITH H. WHETHAM. Longmans Green. 63*s*.

The period covered by this book is one of the most interesting in our agricultural history. It is also the most overwhelmingly documented. So this is no work of original research. It is what the French agreeably call 'vulgarization' at its most scholarly; and the authors have reduced a vast mass of highly varied material to a coherent and comprehensive story with learning, insight and a quite exceptional lucidity.

The general outline is familiar, though this is the first time that the farming history of England, Wales and Scotland has been treated as a single theme. The book begins with an analysis of the industry in the 1840s and follows the fortunes of men and methods through the 'High Farming' and the later depression to the relative stability of the Edwardian era. Admirably referenced, it makes effective use of charts and of interspersed biographies of representative men like Pusey, Hall, Jenkins and the mythical John Steadyman of Cidershire. It shows, too, an appreciative sense of such significant details as the tragedy that befell the young George Edwards, the remarks of George Hope on 'the boys brought up with me', and the origins of the *Journal of Agricultural Science*.

Criticism of such a work is inevitably no more than a statement of personal preference in the choice of material and weight of emphasis. For example, the prophetic Heape might have received mention. So might the historical importance of the silage experiments of the 1870s and '80s as the final bid by the last generation of 'improving landlords' for a continuance of their technical leadership. Again, readers accustomed to the speed of contemporary change would surely welcome further explanation of the curious inability of so many of our grandfathers to adapt their hopelessly defeated system to the new conditions. And, incidentally, is not Eleanor

Ormerod's autobiography a better source than the secondary reference given on page 279? But such comments, which are really regrets that the book could not include more than it does, are themselves tributes to the authors' success.

This is an important book. Important, of course, for content, since it describes authoritatively and thoroughly the development of a farming structure which still influences our work and thought. But also important for sheer intellectual quality. It should be read by all those concerned with farming problems for the understanding it brings as well as the information it contains.

We have been waiting a long time for a book of this kind on this subject. Now it has come. Let us use and enjoy it.

N.H.

Poultry Keeping Simplified. JIM WORTHINGTON. Faber and Faber. 16*s*.

With Jim Worthington writing about hens, one would certainly expect an interesting, if perhaps at times controversial, book. I have a feeling, however, that this book is not really about Jim Worthington's hens but essentially about Jim Worthington. Throughout one can see his character emerging—a mixture of his charming erudite manner, the twinkle behind his spectacles, a story or two and above all belief that his philosophy is right and a willingness to argue it. This then is Worthington's World, his creed into which his hens are woven in a pattern Worthingtonian.

When I was a boy I was very fond of Speakers' Corner in Hyde Park, and this book is just as refreshing, argumentative and often an illuminating address. Without doubt, it is worth buying and worth reading, if only as an attempt to evaluate oneself and one's methods against an ideal which, ostensibly despising any method, nevertheless achieves a great deal in labour-saving and organization.

Above all, this is a book that should be taken in the context of the new leisure which a shorter working week is bringing to so many unsuspecting persons; couple this extra leisure with today's leaning towards 'off-the-farm' produce and those with time to spare and a little money could well find a wholesome and enjoyable pin-money field.

C.T.R.

The Vegetation of Scotland. Edited by J. H. BURNETT. Oliver and Boyd. 6 *gns*.

Ecologists, conservationists and agriculturists who are looking for a comprehensive account of Scottish vegetation and an extensive bibliography of the subject, need seek no further than this new book. The Editor first reviews the previous papers on Scottish vegetation and summarizes the objects of the present work. As far as possible, communities have been described by a system comparable with that used by Continental ecologists, enabling ready appreciation of the relationships between Scottish and Continental vegetation groups.

In Part I, on the climate and soils of Scotland, the information required by an ecologist about temperature, rainfall and humidity, solar radiation and wind is discussed, followed by a brief review of the phytogeographical effects of potential water deficit. The geology and geomorphology of the complex of soils is summarized and the relationship between rainfall, evaporation and soil type considered.

Part II describes the various vegetation groups in Scotland, dealing first with the coastal areas, through the *Armeria* or *Plantago* dominated sites, the rhizomatous communities of talus slopes to the *Festuca* dominated grasslands. Sandy foreshore vegetation is considered separately from dune formation and development, both groups being treated most interestingly.

The chapter on woodland and scrub contains the arguments for and against sheep and other browsing animals being the cause of lack of regeneration of natural woodland and will particularly interest conservationists. The next chapter, on grasslands of the forest and sub-alpine zones, examines the effect of grazing animals on these communities. Much work obviously remains to be done on this aspect to clarify the position regarding the interaction of vegetation, stock and productivity. The upland pasture communities are described in detail, and the chapter closes with pertinent remarks on the loss of nutrients from hill land and a suggestion that the spread of bracken may be beneficial in that it arrests the process of soil nutrient depletion.

Dwarf shrub heaths are then considered, in particular *Calluna-Vaccinium* dominated areas. The diversity of origin of heaths is gone into thoroughly while utilization of these communities is nicely argued among afforestation, better management of existing heaths and conversion to small, highly productive areas of grassland.

Much of the material on loch, swamp and bog vegetation may appear to be of

peripheral concern to agriculturists but all interested in vegetation will find a comprehensive account of the methodology of ecological research and much information about the reclamation of mires and bogs. Part II ends with a discussion of montane shrub, grass and moss communities found above about 1,000 feet and of herb and fern meadows at similar altitudes subject to grazing by wild animals.

Part III deals with the history and pattern of the Scottish vegetation, briefly following its course through grass and sedge communities, *Calluna* dominated tundra, forest and bog and the later changes modified due to utilization by man and his animals. This Part could with benefit have preceded Part I.

Aided by ecologists and conservationists actively engaged in problems of vegetation, the editor has produced a comprehensive account of Scottish vegetation. Perhaps it is not until this book has been read that one fully realizes how great the need was to collate the scattered information. The coverage could have been improved by a consideration of the vegetation of state and privately-owned woodland and of permanent pasture; in both the natural vegetation may be subject to more or less rapid change. There may, however, be little information on these topics as is the case with islands, screes and cliffs. Awareness of the need for further studies is evident throughout, in particular of the causal factors involved in stability and change.

D.J.M.

Tenure of Farm Land. National Farmers' Union. 5*s*.

This is a report by a working party of the N.F.U. Parliamentary Committee set up to consider what changes are needed in the law of landlord and tenant of farm land.

In under two years it has produced a report and recommendations which, if put into practice, would mean very drastic changes in some respects. There would be big changes in the landlord's freedom of action.

After a short introduction reviewing the landlord/tenant system and expressing belief in its fundamental soundness, the report goes on to consider rent.

The working party concludes there is no alternative to a cash rent. They dislike the theory that rental value should bear an economic relationship with vacant possession sale values. They criticize also the open market yardstick and think the 1958 Act should be changed so that a sitting tenant may pay less than his fellow farmers would pay in open competition.

Security of tenure is considered and the present provisions found to have worked well. The long-lease system is rejected (the Scots seem to like it), loopholes in the law are considered with recommendations for closing them, and more protection is wanted for sub-tenants.

Tenancy agreements have been looked at and many found to be out of date. There is a recommendation that the Agricultural Land Tribunal shall have power to revise these agreements.

Compensation, dilapidations and fixed equipment are considered at length and some sweeping changes suggested, all aimed at improving the tenant's position.

An appendix lists a number of minor amendments of the present legislation, which taken together would constitute a major change in the agricultural code.

The working party in its final paragraph rightly recognizes that further legislation on the lines recommended might reduce still further the already limited supply of farms to rent.

This report deserves close attention by all concerned with the agricultural partnership. Copies may be obtained from the N.F.U., Agriculture House, Knightsbridge, London, S.W.1.

C.R.

Metals for Engineering Craftsmen. Rural Industries Bureau. 12*s*. 6*d*.

Metallurgy is a highly specialized subject, introduction to which is, in the main, confined to fearsome-looking volumes full of technical data shrouded in the mystique of the professional. This is a pity, for the subject is an exciting one, ranging from geology, through mining, smelting, refining, research and manipulation, to the many everyday commodities that we see about us.

This book has been compiled primarily for the guidance of small users, and will, it is hoped, disperse some of the mystery and whet the appetite for a greater understanding of the structure and properties of those materials that engineering craftsmen are so adept at shaping.

Adjustments and Economic Planning in Canadian Agriculture. DR. P. HARSANY. Academic Publishing Co. Ltd., Montreal. $3.50.

Students of economics may well be interested in this 116-page booklet. The economic status of farming in the Dominion in a period of change is closely examined in relation to the national economy, and the symptoms, frequently reflecting a number of factors, are probed. It is Dr. Harsany's aim to evaluate the problems and thereby anticipate the future trend of the Canadian agricultural industry. In the course of his search he has drawn upon a number of authorities and presented a wealth of figures.

E.D.

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